Medical Library

The Physiotherapy Review

Vol. XII No. 6

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Common Sense vs. Magic in the Treatment of Mental Diseases

By F. A. Moss, M.D., Ph.D.

Note: The substance of this paper was presented to the District of Columbia Chapter under the title, "Mending Broken Personalities" and interested this chapter so much that we asked permission to publish the full text.

The scientific development of a people is inversely related to the number of supernatural causes that are given for natural phenomena. The more primitive and superstitious the people, the greater the number of supernatural explanations will be given, and the more highly developed the civilization, the more will physical or naturalistic explanations be resorted to. With primitive people, practically all phenomena are explained on a spiritualistic basis. Rivers have spirits; fires have spirits; there is a spirit in the trees; the sun moves across the heavens drawn by spirited horses; and individuals become sick because of evil spirits or because they have offended some deity. In our own civilization, the psychic and supernatural are no longer given as casual agents in the phenomena of astronomy, geology, physics and chemistry, and since the discovery of germs, such explanations have very largely passed out of general medicine, the result being that most branches of medicine are beginning to be placed on a true scientific basis. There is one field of medicine, however, where metaphysical explanations are still very popular; that is, the field of mental disorders. While scientific progress has been great within the last hundred years, it has had to fight every step of its way against the stubborn opposition of superstition and entrenched ignorance. Let us look for a moment at the history of psychiatry.

I. THE HISTORY OF MENTAL DISORDERS

A. The Primitive Era:

As would be expected, the primitive period is characterized by prevailing ignorance and superstition regarding the cause and methods of treatment of those afflicted with mental disorders. Abnormal mental states were explained in terms of supernatural intervention. Symptoms were regarded as the manifestations of some god or demon inhabiting the body of the sufferer or acting upon him from without. Methods of treatment were consequently designed either to placate the god or to drive out the demon. This attitude is seen in many of the Biblical references, for example, Saul's recurring periods of depression, when "the evil eye of the Lord was upon him," were treated with music when "David took a harp and played with his hand, so Saul was refreshed and was well and the evil spirit was departed from him."

B. The Era of Ancient Medicine:

Civilization is like prosperity—it does not move forward in a straight line, but has its rhythms of progress and regression. There are times when it looks as if the progress of several hundred years would be totally wiped out, and in some instances this has been true. But truth has a way of rising again; although it may be submerged

for hundreds of years it will eventually come back to re-establish itself. This is seen in the vicissitudes which have accompanied the study and understanding of mental disorders.

About four hundred years before Christ, under the guidance of Hippocrates, the first scientific attempt to understand mental disorders was made. Hippocrates was the first man to emphasize the fact that mental phenomena are only the result of body activity, and that the way to treat the mind was to cure the body. In dealing with mental disorders, he did not resort to the supernatural in his explanations of treatment of these diseases. He laid down the principle that the brain was the organ of the mind and that mental diseases are essentially physical in their causation. Although all primitive peoples had regarded epilepsy as the "sacred disease," Hippocrates considered it no more sacred than any other disease. He scorned the use of amulets, charms and other psychic methods of treatment.

The next bright spot in the scientific understanding of mental disorders was found in the writings of the scientific Roman philosopher, Lucretius, who also stressed the fact that the brain is the primary organ of thought and that the functioning of the brain depends upon the functioning of the body as a whole. He showed that when the patient was suffering from a generalized infection, delirium followed, and the delirium was the result of the disease rather than the result of any supernatural agents. He showed that when a man ingested too much of any toxic product, such as alcohol, he became insane, the insanity resulting from the toxic substances rather than from any supernatural happening. He observed that just as the bodies of old people become deteriorated with age, so the minds of the old undergo a similar deterioration, and if life exists long enough, ends in senile dementia. He gave very excellent descriptions of such conditions as epilepsy, and he attributed it to bodily disturbances rather than to divine intervention. But unfortunately the teachings of Hippocrates and Lucretius were soon forgotten in the long Dark Ages that followed them.

C. The Dark Ages:

With the middle ages there was a return to the primitive conception of insanity. The Christian religion ushered in a conception of soul as something that had no relation to the body. The belief in demon possession was widespread and mental diseases were uniformly attributed during this period to supernatural causes. Even when persons suffering from mental disorders were recognized as such, they were considered problems for the clergyman rather than for the physician, and miraculous cures were sought. Many phenomena which we today regard as abnormal were with them looked upon as inspired and many insane persons were revered as saints. The trances and visions of their saints are very similar to those seen in the insane today. In all mental hospitals we find those who claim to speak directly with God, who hear voices from invisible persons, see visions, and have divine missions to perform.

During the Dark Ages, if insanity took a religious turn no activity was too absurd or grotesque to provoke anything but awe and reverence. Notice, for example, the behavior of a few of those cannonized as saints and held up as the ideal of human excellence. Saint Macarius slept for months in a marsh, exposing his naked body to the stings of venomous flies; Saint Simon Stylites spent the greater part of his life on a pillar sixty feet high; and Saint Anthony, the partriarch of monasticism, had never to extreme old age been guilty of washing his feet. If such behavior were manifested today, the "saints" would immediately be sent to an insane asylum for care and treatment.

While those suffering from the religious type of insanity were revered as saints, those whose delusions took another form did not fare so well. They were supposed to be possessed of devils or they were persecuted as witches. The treatment meted out to these unfortunates is most revolting. Since they believed that the patient had a devil in him, they treated him as they would have treated the devil if they could have laid hands on him.

The conception of men concerning the relation of mind and body very largely determined their behavior. The body was looked upon as the temple of Satan and had to be watched most diligently to be kept under the subjugation of the spirit. It was regarded as the earthly prison house of the spirit. Mind and body were two very distinct entities. Mind and spirit were synonymous. With such a distorted belief concerning the relation of mind and body, one could not expect a rational consideration of mental disorders. If the mind is something apart from the body, it can certainly not be subject to the same disease that the body possesses, and hence the mind cannot be influenced by physical agents. Therefore, all mental disorders must come from a supernatural cause, either divine or diabolic, and must be treated by psychic or spiritual means.

One of the most characteristic products of medieval thought was the attitude toward witchcraft. In the principality of Treves alone, within a few years over six thousand people were executed as witches. In America, only thirty-two so-called witches were put to death, but in Europe about half a million were executed. Witchcraft was diagnosed by some of the same symptoms which we recognize as present today in such mental disorders as hysteria. No doubt many of the witches were insane. It is also probably true that some of those who accused them were insane, and there is little doubt that a number of innocent people were put to death because of the absurd accusations of some disordered mind.

D. The Modern Period:

In the latter half of the eighteenth century, Mesmer in France began treating mental disorders by suggestion and other psychic methods. He was a pioneer in the development of hypnotism which he used in the treatment of hysteria and other "functional" diseases. Many of Mesmer's principles are today used by the psychoanalysts. Mesmerism is now in disrepute, and is practiced mostly by charlatans, but its successor, psychoanalysis, is enjoying a thriving popularity. The human weakness on which such theories as Mesmerism, Coueism, psychoanalysis and various other "isms" depend for popularity was very excellently stated by Morris Fishbein, editor of the Journal of the American Medical Association:

"The human being revels in mystery and magic. The craving for the mysterious seems to dominate reason except in rare individuals. Even an Oliver Lodge and a Conan Doyle, becoming old, pursue the spooks. Regardless of the marvels that may come as the effort of science, regardless of the mystery of the airplane, the radio, the effects of radium and of X-ray, the average man looks for something beyond. The hocus of table-rapping, levitation, spirits in cupboards, and the handkerchiefs changing color, is to him more awe-inspiring and wonderful than the progress of chemistry. While the average man in health is thus the victim of all sorts of impossible notions, the average man in disease is much more the subject of credulity. In times of pain and affliction, he casts reason aside and is ready to be-

lieve anything that may be urged upon him by his neighbors, by the corner druggist, and by all the quacks and nostrum promotors who have something to sell. Be it faith-healing, healing by the power of suggestion, or some potion or apparatus whose effects are largely secured through the power of suggestion, the shekels are 'readily forthcoming'."[1]

The theories of Freud have taken hold of the American mind with the same vigor with which "keeping kissable with Old Golds" and "being kind to your Adams Apple" with Lucky Strikes have appealed to it. Some psychiatrists have become so imbued with the teachings of Freud that they have become oblivious to the fact that germs, drugs and other physical agents cause mental disorders, and that the only way to cure the patient is to remove these physical agents and to restore the underlying bodily structures as nearly as possible to the normal condition.

In making the above statement I am aware that I shall probably offend some very good friends of mine who are Freudians. And I do not wish to imply in any respect that they are not honest and sincere in their belief. But because a belief is sincere and because the people who practice a cult are honest, does not by any means imply that the belief is correct. Our New England forefathers were very honest in the belief in witchcraft and very sincere in running down witches. They used means in detection of witches almost as elaborate as the Freudians use in detecting complexes, and when the witch was once detected she was treated even more vigorously than the individual suffering from "suppressed desires" is treated today. The Freudian doctrines are quite intriguing and read like a story of magic. As a means of entertainment for an evening's diversion, they have much to recommend them; but as scientific contributions they are devoid of all the earmarks of science.

My chief objection, however, to the Freudian theory is that it acts as an anesthetic to paralyze true scientific investigations. For it takes the attention and efforts from the physical and focuses them on the metaphysical. Nothing could be more deadening to future progress and true scientific understanding of mental disorders than the general acceptance of the theory which explains mental diseases in terms of mysterious, psychogenic causes resulting from the suppressed memories of infantile sexual experiences. For when an investigator is actuated by such a theory, he abandons all effort to discover the true casual agent and to trace the tissue pathology resulting therefrom. He makes no effort to find a physical agent with which to remove the offending cause, and to restore the tissue to normal. True science is thus replaced by untrammeled imagination. As Myerson has well said: "One of the strangest things in the history of science is the rise into dominance of some scientific theory which becomes established as a dogma, checking the free growth of knowledge."

II. The Scientific Conception Necessary for an Understanding of Mental Disorders

To understand the mind and its diseases you must first understand the body and the physiological processes on which the mind rests. The mental processes have just as materialistic a basis as do the digestive processes. The mind is merely the result and accompaniment of the functioning of the body as a whole, and its integrity depends upon the integrity of the underlying bodily structures. Mind is most intimately related to the nervous system, but it has its roots in the endocrine glands, the viscera, and even the muscles, bones and joints contribute their quota to the sum total that we call personality. Mind depends upon the number of nerve cells, their maturity, their connections, their nutrition, and the absence of toxic products. The interdependence of nervous system and its functioning and the circulatory system and its functioning are just as close as the interdependence of digestion and circulation.

Mental life has never been observed apart from the functioning of the nervous system; and we must therefore logically conclude that it is dependent in some way upon the physical, chemical and organizational properties of nervous tissue. A blow on the head does something to the underlying nervous tissue that destroys consciousness; destruction of brain tissue by tumorous growth or trauma likewise interferes with mental efficiency. The dependence of consciousness on a certain chemical condition in the brain is well exemplified in nitrous-oxide-oxygen anesthesia. When the patient is given a few breaths of nitrous oxide, consciousness vanishes; but all we have to do to restore consciousness is to let him breathe oxygen for a few moments. It is likewise exemplified in the mental disturbances accompanying diabetic coma or insulin shock. If the diabetic takes too much sugar, he goes into a state of coma; and when some insulin is given him, the coma vanishes and consciousness returns. And if by chance he takes too much insulin, he goes into a comatose condition from the opposite cause, but all that is necessary to restore him to consciousness is sugar in some form, such as glucose or orange juice. If the thyroid gland is removed, a beautiful and intelligent child will become a hideous imbecile, unless fed thyroid extract. Wherever we look, we see life in only one form, composed of certain chemical compounds—hydrogen, carbon, oxygen, and nitrogen; living within certain narrow limits of temperature; giving out exactly as much as it takes in; dependent for its energy upon the food substances from the outside, and being poisoned and disturbed by the most absurdly small doses of certain chemical substances. Let us consider in more detail some of the physical agents that cause mental disorders.

III. Things That Cause Mental Disorders

The human machine and consequently personality is affected by all sorts of agents, both external and internal. Space will permit the consideration of only the more important of these.

A. Mechanical Agents:

If nerve tissue is the chief basis of mind, it follows naturally that if you destroy the tissue, you destroy its function. Injure the brain and the mental life is interfered with. We have only to witness the loss of consciousness following a severe blow on the head, or the mental deterioration which follows serious brain injury, or the complete personality change which accompanies destructive brain tumors to recognize the importance of mechanical agents in producing mental disorders. In some cases of fracture of the skull a piece of bone pressing upon the brain may profoundly change one's memory, mood and general personality, and removal of this piece of bone restores the mind to normality. Likewise, with certain types of brain tumors: if they can be detected early and removed, the individual is restored to normal. Thus we see demonstrated that certain physical agents cause mental disturbances, and also that certain physical agents, such as the surgeon's knife, may re-establish normality.

B. Bacteria:

While bacteria play a part in the causation of a number

[1]Fishbein, Morris: Shattering Health Superstitions. Horace Liverright, 1930, p. 13.

of mental diseases, I shall mention only two so caused.

Take the disease known as general paresis. This disease, as all of you know, is a late stage of syphilis, and the same microorganisms that cause syphilis cause this disease. When this organism invades the nervous system, profound mental and neurological changes result. The energetic man becomes lazy; the vivacious, dull; the virtuous, dissolute; the miserly, extravagant; the timid, aggressive; and the truthful, false. Judgment wanes and absurd delusions and hallucinations constitute the mental life. With the failure of judgment, marked egotism and grandiose ideas develop. The patient becomes boastful, says that he is Napoleon and delights in telling of his wonderful powers and accomplishments. A previously respected citizen, maybe one of the pillars of society, suddenly begins to associate with dissolute characters and to sink into the depths of debauchery. The disease is progressive, and unless treated, the personality of the individual is soon destroyed. It is only within the last few years that satisfactory methods have been available for treating this condition. By the use of the malarial treatment a large percentage of the patients can be returned to society. Here we have a disease caused by a definite physical agent which produces a very definite physical pathology of the brain and nervous system. It can be diagnosed by definite physical and chemical methods, indicated by changes in the spinal fluid. And it may be treated and cured by definite physical agents, malaria and diathermy.

We have another mental disorder, encephalitis lethargica, which apparently belongs in this same general group. At present we are not certain of the particular organism that produces the condition. We do know, however, that most of the cases are preceded by some such disease as influenza; we know that the offending organism invades the brain tissue and sets up a definite inflammatory condition. We know that as a result of this inflammatory condition the personality of the patient is markedly disturbed and a definite mental disorder frequently results. The man who was previously filled with energy and zest becomes dull and lethargic. He is unable to maintain his attention on any subject, even dropping off to sleep while you are talking to him. At present, we have no satisfactory method of treating the condition and unfortunately it is tending to become more common.

In closing this section, we should recognize that except for the accidental invasion of those bacteria, the personality of the individual would have continued on its normal course; but with their invasion certain definite bodily pathology results which produces in the individual a definite mental disorder.

C. Drugs:

The most ancient and primitive peoples of whom we have any record have sought the pleasure and relief from the toils and monotony of existence which seem to be furnished by certain drugs. Nothing will so completely and quickly change one's personality as such drugs as alcohol, opium, and cannabis indica.

1. Alcohol: A pint of whisky will change the personality of any man. The differences between a man drunk and the same man sober are so marked as to make him appear entirely different. The intoxicated man reels as if he had a tangle in his legs, shows a stuttering speech and an intellect besoaked. He shouts and brawls and in many instances is very loquacious, with much gesticulation. As the brain becomes more involved, the sense of responsibility is lost as well as the ability to discriminate between the trivial and the important. The drunken man loses his regard for the feelings of others as well as for the ordinary decencies of life. All that is necessary to return him to normal is to give his body time to rid itself of the alcohol.

But if the individual continues to take excessive amounts of alcohol over a long period of time permanent damage may be done. He may develop a definite alcoholic psychosis. There are several well-defined mental diseases which result from the excessive use of alcohol. In delirium tremens, for example, the patient presents a picture very much like the delirious states found in infectious fevers. He has vivid hallucinations, most frequently in the visual field. He sees snakes, spiders, rats, elephants, skeletons, and grinning and hideous monsters which threaten him. In another type of alcoholic disorder, the patient has delusions of persecution and hears voices accusing him of all kinds of wrong doing and saying very disgusting things to him. If these patients during their greatest excitement are placed in a continuous bath and are given drugs to help them eliminate the alcohol, after a few days as a rule they return to normal. Like, the poor whose main trouble is their poverty, the alcoholic's chief difficulty is his alcohol.

2. The Opiates: While the opiates are not so widely used as alcohol, their personality changes produced by them are even more marked. At first there is a feeling of euphoria and well being. Drug addicts refer to opium as "God's own medicine" and say that it makes them feel as if they were "sitting on top of the world." De Quincey, speaking of opium, says:

"Here was a panacea for all human woes; here was the secret of happiness about which philosophers had disputed for so many ages, at once discovered; happiness may now be bought for a penny, and carried in a waistcoat pocket. Portable ecstacies might be corked up in a pint bottle and peace of mind sent down by mail."[2]

But there is another side to the picture. Continued use of the drug leads to addiction, and addiction causes mental chaos. Nights are spent in restless insomnia, and a cloud of depression hangs over the user's days. When the effects of the drug wear off, sensations of lassitude and melancholia follow. The patient is restless and irritable, and unable to remain quiet for any length of time. Persons addicted to these drugs become inveterate liars and no reliance can be placed in what they say. No cure is at present known for the diseases resulting from drug addiction. At the present time, physical chemists are working on a method that seems to promise some relief. One thing is certain, that drug addicts cannot be cured by being talked to. Their disease is a definite physical disease, produced by the effect of the drug upon their bodies; and to cure them, some method must be found of restoring their bodies to normal.

Many other drugs, such as veronal, which can be secured without a prescription at any drug store, are causing an increasingly large number of mental disorders. But time will not permit a detailed discussion of them. We should recognize, however, that mental disorder is the result of drug addiction, and except for the drug addiction there would be no disorder.

D. Glandular Agents:

According to Huxley, "The ductless glands, among other things, secrete our moods and our philosophy of life." Next to the nervous system, the glandular system is most important in determining personality. The glands act as directing forces in maintaining mental and emotional adjustments. Failure of some of these glands causes a corresponding failure of adjustment. For example, a deficient thyroid in childhood produces a cretin —an individual both physically and mentally dwarfed.

[2]Thomas De Quincey, Confessions of an English Opium-Eater.

Even if he lives to adult life he will have the mental age of an idiot or an imbecile. But if he is given a sufficient amount of thyroid material early enough in life, his mental condition will approach normal.

If the thyroid is markedly underfunctioning in adult life, we have a condition known as myxedema. The patient's mind becomes dull, his memory weakens, his speech is slow and difficult, and his general attitude is one of apathy. His body weight is increased and his sexual functions are markedly decreased. His face is expressionless and stupid in appearance; but if he is given the proper amount of the dried thyroid gland of the sheep, his mental condition returns to normal. Here again we have a definite physical condition producing mental abnormalities, and it is in turn corrected by a physical agent.

Mental disorders may result from the disturbances of more than one gland. Such a condition is seen in involution melancholia. This condition is most frequently seen in women and occurs as a rule between the ages of 45 and 55. It is caused primarily by deficient functioning of the sex glands, but the pituitary and thyroid contribute their part to the disturbance. In the beginning of the condition, the patient manifests some irritability, has a tendency to unexplained changes in mood, and depression seems to permeate her whole existence. In extreme cases she becomes, as it were, "saturated with grief," and filled with anxiety. Persons suffering from this condition carry a look of pain and go around with drooping facial muscles and wrinkled brows. They often refuse to take food and in many instances claim that they are unworthy to eat. They may have delusions of sin, and claim to have committed the "unpardonable sin." They lose interest in the outside world and become absorbed in their own misery. The sexual instinct is markedly diminished, self-confidence, emulation and rivalry are gone. Due to their depression, the patients become markedly suicidal and unless prevented from so doing, many of them will take their own lives. The condition has recently been successfully treated with a combined glandular therapy consisting of a preparation from the anterior lobe of the pituitary gland and preparations from the thyroid and the sex glands. After a few months of this treatment the depression vanishes and the patient returns once more to her normal self.

E. Deficiency in Brain Cell Nutrients:

No matter how well born, our brains cannot function normally without a proper environment of nutrients and food material. The finest collection of brain cells in the world would cease to function immediately if the circulatory avenue for nutrition were cut off. They would fall down in efficiency if supplied with insufficient nutrient materials or if the blood supply is loaded with the waste products of fatigue. They would become markedly disturbed in their functioning if the blood stream is loaded with toxic substances. The functioning of the entire body, especially of the nervous system is at the mercy of the environment which supplies all the substances for life, nutrition, and energy. Either insufficient food or food of improper quality may affect one's mental efficiency. An ill-nourished brain or nervous system does not function any better than an ill-nourished muscular system. In the case of some nutritional deficiencies involving particularly lack of vitamins, specific personality disturbances arise. A typical example of the effect of food deficiencies on mental life is seen in the mental disturbances which accompany pellagra. And all that is necessary to prevent these disturbances is a properly balanced food supply.

F. Deficiency in Brain Cells:

Just as some parents pass on to their children an inheritence of several million dollars, while others transmit only debts and poverty, so some parents give their children millions of healthy brain cells while others transmit to their children a relatively small number of deficient, sickly cells. Poor heredity means in many instances a poor start in life, and a poor physiological machine. It would be just as logical to expect a one-ton truck to carry successfully a ten-ton load as it is to expect a person born with a deficient number of brain cells to maintain a normal personality. The only remedy for these hereditary deficiencies is in some form of birth control.

G. Tissue Deterioration with Age:

The human machine like any other machine must wear out; and like other machines some parts of it may wear out before the others. If the nervous system or the glandular system wears out before the other systems, many disturbances of personality result. Dotage and second childhood is the price that one usually pays for extreme old age. The deterioration of personality with old age is produced by a corresponding deterioraton of the brain. At autopsy the brains of the seniles are found to be wasted, shrunken and considerably decreased in weight. The membranes surrounding the brain are thickened and there are often present evidences of hemorrhage. Many cases of senile deterioration occurring in relatively early life are caused by arteriosclerosis, which results in a decrease in the blood supply and consequently a malnutrition of the brain tissue.

Lucretius, years ago, gave a most excellent description showing the exact parallel between body and mind and the corresponding changes which age produces:

"Besides we feel that mind to being comes
Along with body, with body grows and ages.
For just as children totter round about
With frames infirm and tender, so there follows
A weakling wisdom in their minds; and then,
Where years have ripened into robust powers,
Counsel is also greater, more increased
The power of mind; thereafter, where already
The body's shattered by master-powers of old,
And fallen the frame with its enfeebled powers,
Thought hobbles, tongue wanders, and the mind gives way;
All fails, all's lacking at the selfsame time."

—Lucretius.

In the foregoing sections we have considered only the more important and better understood agents that produce mental diseases. There are, however, several agents whose effect is not nearly so well understood. We know, for example, that the gases we breathe have some effect on personality. We can take the catatonia dementia praecox who sits for days or weeks in a stuporous condition, never moving arm or leg, apparently oblivious of all that is going on around him, and by forcing him to breathe a mixture of 40% carbon dioxide and 60% oxygen, we can restore him for the time being to normal. But unfortunately, after a few hours he drops back into his previous condition. Here again we have a physical agent that acts in a definite physical way and produce at least a temporary return to normality. By taking the cue that this gives us, we can feel assured that this type of dementia praecox is caused by a definite physical condition, and that it will eventually be cured by physical rather than psychical means if cured at all.

IV. The Advantages of the Materialistic Approach to the Study of Mental Disorders

At this point, I want to emphasize a few of the advantages of the materialistic approach to the study of mental disorders. In the other sciences, all advancement has been made when materialistic methods were employed. In the middle ages, these methods were least employed, and since science made no progress we refer to those ages as the dark ages. The materialistic methods have given us the steam engine, the railroad, the automobile, the airplane, the telephone, the telegraph, the radio, electric light and power, x-ray, and synthetic chemical products. By these methods we have been able to manufacture from the crude elements in the laboratory such organic glandular products as thyroxin and adrenalin. When we compare these advances with the barrenness of the metaphysical methods, our reasons for choosing the physical approach are obvious. If we ever expect to accomplish anything in dealing with mental disorders, we must employ the same scientific methods that have proved so fruitful in other fields. If we compare, for example, the current procedure in dealing with a broken down car and a broken down mind, the contrast is shocking. The car is towed to the roadside garage where the rural mechanic proceeds scientifically to discover the cause of the mechanical disorder. He takes his machine as he finds it, and allows no mysterious tradition to interfere with the needed adjustments. He proceeds with confidence to materialistic results which can be demonstrated and measured. The brain repair man, on the other hand, is hopelessly handicapped by his preconceived ideas. He may talk about innate depravity and attempt to cure by prayers, incantations, or the laying on of hands; or after many hours of hocus-pocus he may come to the enlightening conclusion that the brain is suffering from an "oedipus complex" and can only be cured by the magical method of dream analysis.

I should like to emphasize especially that what little we know about mental disorders has been found out solely by materialistic methods. The disease, general paresis, has been known for many years, and it was attributed to many spiritualistic or psychogenic causes. The old books on psychiatry used to teach that general paresis was caused by such psychogenic agents as business failure, the death of relatives, or disappointment in love. And it was treated by the usual psychic methods, with one hundred per cent bad results. But some twenty-five or thirty years ago it was discovered that a physical agent, the Spirocheta pallida, caused the disease. It was next discovered that this agent acted on the brain and caused definite physical damage. It was next discovered that the presence of this disease could be detected by certain chemical analyses of the spinal fluid (more physical phenomena). And finally it has been found that the disease can be successfully treated by giving the patient malaria. Another physical agent. Here we have a mental disease, caused by a definite physical agent, which causes a definite physical brain pathology, which can be diagnosed by physical means, and successfully treated by physical methods. All these discoveries have been made within the lifetime of a number of my hearers.

In conclusion, I should like to emphasize that if we hope to find cures for mental disorders, we must go back to our laboratories and give up our seances with the Freudian metaphysicians. No one would expect to cure a broken-down automobile by merely talking to it, but many people expect to cure broken-down personalities by the magical method of dream analysis.

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Therapeutic Fever with the High Frequency Current in the Treatment of Syphilis*

By Frank Hammond Krusen, M.D.

For several years, physicians have been striving to produce fever by artificial means.

A century ago, fever was considered synonymous with disease, and the internal medication of the last century was directed towards combating fever, chiefly by means of the coal tar derivatives. More recently, it has been noted that fever was present in practically all self-limited diseases, while absent in diseases which were not self-limited. It is now felt that fever is a protective measure against disease, and an effort has been made to produce fever artificially, in the treatment of certain chronic diseases. "Medical science is apparently beginning to view the presence of fever as a benign effort of nature." Years ago, horse hair was pulled through the skin of the chests of paretics to produce abscesses and fever. Crude turpentine was injected to create abscesses. More recently, sulphur in oil, proteins, milk, tuberculin, sodium nucleinate and various vaccines have been used by injection for the same purpose.

Starting with the work of Wagner von Jauregg, in 1917, with the malarial treatment of paresis, various methods of producing fever have been suggested.

Plant inoculated his patients with undulent fever.

Solomon, Berk and others, in 1926, reported on the use of sodoku or rat bite fever.

Kunde, Hall and Gerty, in 1927, reported excellent results with typhoid vaccine.

In 1929, King and Cocke, of Nashville, Tennessee, reported on the use of high frequency currents for the fever treatment of paresis, and almost concurrently, Neymann and Osborne, of Chicago, reported on the same subject.

Still more recently, W. R. Whitney, of Schenectady, has suggested the use of short radio waves (ultra-high frequency currents) for the production of fever.

It is still too early to report on these radio waves in the production of fever; however, we *can* report partially on the effect of ordinary high frequency or diathermy currents.

Hot water baths have been used successfully by Schamberg and Tseng and by Mehrtens and Pouppert, in the experimental treatment of syphilis. Carpenter has recently experimented on rabbits with the ultra-high frequency current, and he has reported that "the heat produces in the body an unfavorable environment for the spirochete."

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Disraeli Kobak writes: "The work of Carpenter suggests that a new approach may possibly be found here in the treatment of syphilis, irrespective of type or age. Studying the effects of ultra-high frequency currents in a group of 25 luetically infected rabbits, 21 showed no lesions (no chancres). 5 of this group developed nodules in their testes, the size of a pea, during the treatment; but by lengthening or intensifying the exposures, the lesions disappeared." "The Wassermann and Kahn tests showed a parellel reduction in the treated animals."

Cady and Ewerhardt have recently reported that "High body temperatures induced by hot baths are definitely not harmful to the syphilitic patient and usually exert a beneficial clinical effect. In Wassermann-Fast patients, it tends to cause reductions in their serological reactions when used in conjunction with drug therapy."

Schmidt and Weiss report that "Hyperpyrexia by means of diathermy has demonstrated its value to such a degree as to warrant its use in chronic neurological conditions."

Disraeli Kobak states: "The temperative raising properties (of high frequency circuits) remains a spectacular demonstration, if not a mystery. But no matter how it may for the moment appeal to our minds, of greater import is the growing enthusiasm for the method in producing and controlling artificial fever. It is at present becoming highly accepted as the safest method of inducing hyperpyrexia in dementia paralytica cases."

King lists the disadvantages of malarial treatment as follows: "1. It necessitates giving the patient a disease that is difficult to cure and in some instances does irreparable injury to the vital organs of the body. 2. The desired strain of plasmodium is often not available and is very difficult to keep where the number of patients under treatment is not large. 3. Certain individuals have an immunity to malaria, particularly in the colored race. 4. In many cases, the malarial paroxysms stop spontaneously before the desired reaction is produced, while others have only slight elevations of temperature. 5. One has no means of controlling the intensity and severity of the malarial attacks without stopping them altogether. 6. Medicinal treatment and malaria cannot be given simultaneously."

In contrast, the high-frequency currents offer the possibility of production of fever at will. Neymann states this is "something never hitherto accomplished" and that "any type of temperature curve can be produced." The fever may be produced daily or on alternate days, or at any interval desired. The fever production may be stopped at any time, if untoward effects are noted. Medicinal treatment may be continued during the treatments. There are apparently no marked residual effects.

King states that fever by diathermy was first instituted "to determine whether the beneficial effects were produced by the elevations in body temperature per se, or whether they were brought about by some biochemical reaction to the malarial parasites or foreign protein." He continues: "When our first report was made of this work in November, 1929, twelve patients had received a satisfactory series of eight to twelve treatments given at intervals similar to the malarial paroxysms. At that time eight of the cases had shown definite improvement mentally. Two had had complete clinical remissions and eleven of the twelve had shown a gain in weight and improvement in their general well being. At the present time, the two cases that showed clinical remissions are still at work, successfully carrying on their original occupations. Five of the eight have maintained or shown further improvement in their mental state, while three have shown some regression mentally. We are still of the opinion that this series of cases is too small to justify any concrete conclusions as to the ultimate success of this form of therapy or of its advantage over others used. However, it affords some very conclusive evidence that the benefits derived in the past from fever therapy by malaria and other substances have been entirely due to the accompanying elevation in the temperature and not to any associated biochemical reaction to the infecting organism." "We are not convinced that it is the surest, quickest and least expensive way of producing an artificial fever."

Neymann reports on the results of 85 cases, as follows: "Though we have treated many different diseases with hyperpyrexia, not enough time has elapsed to make definite statements except in the case of general paresis. At present, we can report on 85 cases of this disease . . . . . 40% of these patients showed an absolute clinical remission, and returned to their former occupations; 19% made a partial recovery, and were able for the most part to adjust themselves outside an institution; 40% remained unimproved . . . . . The results in tertiary endarteritic syphilis of the brain are less encouraging . . . . . Remissions in dementia paralytica, once secured, seem to be permanent. Three years have elapsed since the first cases were discharged from custodial institutions. This far, not a single case has been recommitted. Thus far we have reports on over 150 patients . . . . . Only one death can be attributed directly to this therapy. We made the error of attempting to treat a totally paralyzed and anesthetic patient in the last stages of transverse syphilitic myelitis . . . . . The treatment resulted in a large burn which undoubtedly hastened death . . . . But the death rate from malaria varies between 10 and 33%. It is, therefore, obvious that we are dealing with an infinitely safer method for producing fever." "The prime requisites for the production of artificial fever by diathermy are a well constructed high frequency machine capable of delivering at least 4000 m.a. and preferably 6,500 m.a. of current under load, properly constructed electrodes and thoro heat insulation of the patient." The skin is moistened, the metal plates applied to chest, abdomen and back. The patient is then covered with seven blankets and two rubber sheets. Thorough heat insulation of the patient is thus obtained. The current is turned on gradually. Resistance heat energy "piles up" in the body; and the blanket insulation prevents heat dissemination. The temperature, pulse and respiration are recorded every 15 minutes; or a rectal thermocouple is used, which automatically records the temperature. The temperature usually rises about 4 to 6 degrees in 1 to 2 hours, and it will go higher as the treatment is continued. It may be prolonged at a high point for eight hours, or dropped as desired. Complete control is possible.

Our own experience is too limited as yet to draw conclusions. We have tried it in several chronic conditions, including paresis, but we have insufficient data to report our findings. For instance, Frieberg, of Chicago, and Leopold, at the University of Pennsylvania, have suggested therapeutic fever in the treatment of bronchial asthma. We have tried this, and our first two cases have been made worse by therapeutic fever.

We know only that Neymann has obtained, in 85 cases of paresis, results that are comparable to the beneficial results secured by the malarial treatment.

We do know that we can produce *readily controlled* fevers, and that, properly applied, the method is *comparatively safe.*

It is necessary, however, to have elaborate apparatus, and it requires a great deal of work to give each treatment.

Further study of this method as an aid in the treatment of syphilis is certainly warranted.

Oak Lane, Philadelphia, Pa.

Scoliosis—Etiology, Pathogenesis and Prevention of Experimental Rotary Lateral Curvature of the Spine*

By Eben J. Carey, M.D., Marquette University, School of Medicine, Milwaukee

Given at the Eleventh Annual Convention in Milwaukee

There is an absence of accurate anatomic and physiologic knowledge of the mechanism of production of structural scoliosis. Beginning with Hippocrates, who gave the generic name "scoliosis" to any twisted spine, many volumes have been written on the condition that is now known definitely as rotary lateral curvature of the spine. Most of the evidence presented, however, has consisted of end-results of pathologic processes, the causes and starting point of which have been obscured or obliterated in the majority of patients with scoliosis.

Excellent experimental work and observations on human and animal subjects that have advanced knowledge of the causes of scoliosis have been done by Lovett,[1] Brackett,[2] Scudder,[3] Schulthess[4], Wullstein,[5] Arnd,[6] Thompson and Mendel,[7] Müller,[8] Abbott,[9] Bardeen,[10] Bucholz and Osgood,[11] Kleinberg,[12] Wilson,[13] Steindler,[14] Bohm,[15] Feiss,[16] Nathan,[17] Buchmann[18] and Calvé.[19]

The results of experimental amputations, selective muscle and nerve excisions, tail fixations, undernutrition in young animals, and the dynamics of histogenesis of muscle, bone and joint have been presented[20] in the Scientific Exhibit at the annual sessions of the American Medical Association in 1928, 1929, 1930 and 1931. The biophysical relationship of muscle and bone during the periods of growth and maturity exposed by the experimental method led to a restudy of the normal and abnormal actions of antagonistic muscles that influence either directly or indirectly the position of the spine. A working model of the anatomic and physiologic relations of muscle and bone levers of the normal human back was then constructed. By this means results of experimental muscular imbalance registered at once in the spinal indicator, whereas by animal experiments I have waited months and even over a period of two years for the same changes to occur.

The objective part of the experimental work presented in this paper, therefore, will be confined to certain demonstrations on the dynamic muscle-bone balance model of the human spine. Emphasis is placed on the normal and abnormal dynamic equilibrium of the bilateral musculature of the body as a whole. The interaction of the muscles and the segmental bones of the axial and appendicular skeleton under normal conditions is manifested by body symmetry and under abnormal conditions by variable kinds and degrees of asymmetry.

ETIOLOGY

Scoliosis is a spinal sign of the muscle-bone imbalance of the back and is not a specific disease entity. There is, therefore, no single etiologic agent producing scoliosis. Multitple factors may cause comparable spinal curvatures by upsetting the dynamic equilibrium of the motor system of the back, just as different pathologic conditions may produce the symptom of fever. The kind and degree of scoliosis are dependent on the extent of imbalance caused by the possible multiple combinations and permutations of the paralyzed muscles of the body as a whole.

In both the functional and the structural types of scoliosis, there is a reaction of the spinal indicator to the normal and abnormal dynamic balance of the bilateral body muscles. The degree of rotation about a vertical axis and the extent of the lateral deviation of the spine from the midline are direct indications of the degree of imbalance of different groups of body muscles. There is no direct correlation between the rotary and the lateral deviation components of the rotary lateral curvature of the spine. In one individual the rotary element may predominate; in another, the lateral deviation is dominant. These changes are dependent on the involvement of different combinations of muscle groups.

The dynamic equilibrium of the muscle and bone of the back, leading to permanent structural changes in the bodies of the vertebrae, intervertebral disks, ribs, shoulder and pelvic girdles and lower extremities, may be upset by different pathologic conditions in the following systems of the body: (1) digestive; (2) blood and lymph vascular; (3) respiratory; (4) excretory; (5) nervous; (6) osseous; (7) joint, and (8) muscular sys-

*Read before the Milwaukee Academy of Medicine in December, 1930, and before the American Association of Anatomists in Chicago, April 2, 1931. Also read before the Section on Orthopedic Surgery at the Eighty-Second Annual Session of the American Medical Association, Philadelphia, June 11, 1931. Reprinted by permission from the Journal of the American Medical Association.

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tems. Congenital changes that are the result of arrested growth or overgrowth of certain bones or muscles cause alterations of normal balance of the motor system of the back.

Variot[23] has demonstrated the frequent dissociation of statural and ponderal growth in the human infant during chronic infantile inanition. Growth in muscle weight was retarded more than growth of the skeleton in length. In severe cases the height increased while weight was stationary or even decreased. This dissociation was definite in premature infants, twins and weaklings, especially an atrophy of gastro-intestinal origin. He also demonstrated a physiologic dissociation of height and weight growth during the normal postnatal loss in body weight. Freund[25] stated that acute infections depress weight with no cessation on growth in height. The question of abnormal uncorrelated growth of weight and height has been reviewed by Schloss,[25] Tobler and Bessau[24] and Jackson,[26]

In chronic inanition in albino rats Jackson[26] found that "with a body loss of 36 per cent the musculature lost 41 per cent in weight (table 4)." Miescher[27] recorded that in the fasting Rhine salmon the sex glands develop at the expense of the musculature, which lost over 50 per cent in weight. The superficial lateral trunk musculature was definitely degenerated while the remaining muscles appeared relatively unaffected. This observation was confirmed by Greene[28] in the Pacific salmon.

Aron[29] noted that in an underfed puppy the musculature formed only 29.3 per cent of the body weight, which in a full fed litter mate was 50.2 per cent. Thompson and Mendel[7] stated that in underfed albino mice the characteristic curvature of the spinal column was caused by arrested growth of the skin and muscle, together with the persistent growth of the vertebral skeleton.

Gaglio[30] noted a loss of 85 per cent in the musculature of a starved frog with loss of 50 per cent in body weight. Ott[31] found that in the female the loss in the musculature was even greater in the earlier stages of inanition than in the male frog. Stefko[32] during the recent Russian famine recorded that girls showed a greater loss in body weight than boys.

Ohlmüller[33] and Theile[34] reported that the atrophic child loses a greater percentage of muscle weight than the total percentage of loss of body weight. Nicolaeff[35] stated that variation occurred in the amount of atrophy in the individual muscles of famine stricken children. The functionally active muscles of mastication (temporal, masseter) lost relatively less than the biceps brachii, which sometimes lost 50 per cent in weight.

Statkewitsch[36] studied the microscopic changes in the muscle and other tissues during inanition in numerous animals (mammals, birds, reptiles and amphibians) and gave a detailed review of the earlier literature. He found that in general the skeletal muscle was affected earlier and more intensively than smooth muscle. The degenerative changes appeared first in the cervical musculature, then (in order) in the extremity muscles, the pectoralis major, the heart, the rectus abdominis, and finally the smooth musculature. I confirmed this in the Scientific Exhibit in 1930 in unpublished records of autopsy determinations of muscle weights in marasmic infants, in which there was found a definite inequality of degeneration of the muscles on the left and right sides of the body.[26]

Baker[37] conducted an investigation for the Bureau of Child Hygiene and determined among 171,691 school children 18.5 per cent definitely undernourished and 3.1 per cent with pronounced malnutrition or marasmus, or a total of 21.6 per cent with distinct undernourishment. Up to 6 years of age, 22.5 per cent were undernourished, and at 9 years 25.2 per cent. This condition probably held, according to Baker, for one million school children of New York City. Brown[38] found that 41 per cent of the children in Lowell School of Kansas City were more than 10 per cent underweight.

Malnutrition and partial inanition were therefore very common among children, even under relatively normal conditions. Despite underfeeding or malnutrition there was a persistence of skeletal growth with a great loss of muscle weight. This resulted in dystrophic growth. The extent of muscle degeneration, furthermore, varied greatly not only in different fibers of the same muscle but also in the muscles in the different regions of the body.

The musculature was not, therefore, uniformly degenerated in the undernourished child but presented a condition of focal atrophy. The definite atrophy of the musculature explains the characteristic weakness which generally appeared in both total and partial inanition, as well as in various chronic diseases involving malnutrition. Infantile malnutrition was very common and varied in character and in degree of severity. When pronounced, it was called by various names, such as infantile atrophy, athrepsia, inanition, cachexia, marasmus, hypotrophy, pedatrophy, decomposition and denutrition.

This dystrophy of decreased muscle growth and persistent skeletal growth in the undernourished child, therefore, results in focal atrophy of different muscle groups with a resultant asymmetrical pull or unequal decompression of direct and indirect muscle action on the spine. The class of idiopathic scoliosis; which is more prevalent in girls than in boys and which constitutes, according to Kleinberg,[12] 85 per cent of the total number of lat-

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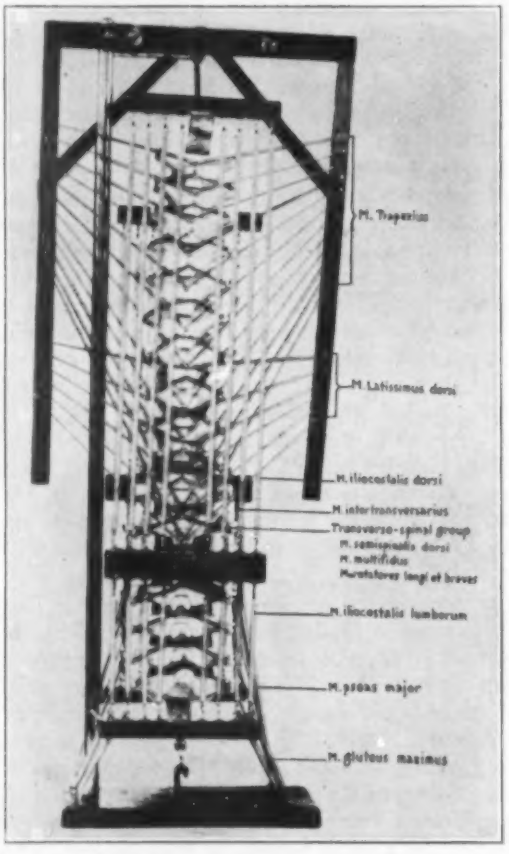


FIG. 1.—DORSAL ASPECT OF THE DYNAMIC MUSCLE-BONE BALANCE MODEL OF THE HUMAN SPINE (ABOUT ONE-FIFTH NATURAL SIZE). THE SPINE HAS NO DIRECT SOLID SUPPORT BUT IS SUSPENDED IN A FIELD OF BILATERALLY BALANCED TENSIONS OF STEEL WIRE SPRINGS. THE TWELVE DORSAL AND FIVE LUMBAR VERTEBRAE ARE COMPOSED OF OAK WOOD AND BETWEEN THE VERTEBRAE ARE PLACED DISKS OF FELT WHICH REPRESENT THE INTERVERTEBRAL DISKS. DORSAD TO THE CENTER OF THE VERTEBRAL BODIES IS A HOLE THROUGH WHICH IS THREADED A WIRE SPRING ONE-FOURTH INCH IN DIAMETER. THIS AXIAL SPRING IS ATTACHED ABOVE AND BELOW TO THE STAND AND PERMITS MOBILIZATION OF THE VERTEBRAL BODIES IN RELATION TO ONE ANOTHER.

eral curvatures of the spine, may well be due to the imbalanced action of the bilateral antagonistic musculature resutling from undernutrition or malnutrition during the first decade of life. There is a definite correlation between the incidence of malnutrition and partial inanition of the child during the first decade of life and that of scoliosis without a definite cause, which is exposed by the statistical method.

PATHOGENESIS

The mechanism of production of the different degrees and types of rotary lateral curvature may be best studied by means of the dynamic muscle-bone balance model of the human spine. This model of the dorsolumbar vertebrae of the human spine in wood and related musculature in steel wire springs was constructed in order to visualize the interdependence and interactivity of the bilateral and unilateral muscular actions in relation to the spinal column indicator. The spinal column is demonstrated to be a dynamic indicator of myogenic equilibrium, the result of neurovestibular control on the bilateral muscles pulling against the resistance of gravity.

This results in body symmetry or asymmetry of balanced or imbalanced muscular activities, respectively. The spine and its neuromuscular relations constitute a functional unit and are roughly analogous to the indicator and its relation in the balance scales. The spinal indicator may, however, be laterally deviated to the stronger or to the weaker muscle side. This depends on whether or not the parallel bowstring or the transverse-traction muscles, acting directly or indirectly on the spine, are unilaterally stronger than a weakened antagonist on the opposite side of the body.

In figures 1, 2, 3 and 4 the axial spine is shown in different aspects in relation to the musculature. I have classified the musculature that influences spinal position on a physiologic basis, with examples in each class, as follows:

1. The superficial parallel bowstring muscles: rectus abdominis, intercostals, sacrospinalis muscles.
2. The deep parallel bowstring muscles: intertransversarii.
3. The superficial transverse-traction-torsion muscles: trapezius, latissimus dorsi, serratus anterior and pectoralis major muscles.
4. The deep torsion muscles: semispinalis, multifidus, long and short rotator muscles.

In the primary curvature the convexity of the spine was toward the strong muscle side when the superficial transverse-traction-torsion muscle was unilaterally weakened (figs. 5, 7 and 9). If the right trapezius muscle was weakened or paralyzed, the overaction of the unopposed left trapezius muscle drew the convexity of the spine toward the left side (figs. 5 and 7). The unopposed action of the right trapezius muscle pulled the convexity of the spine toward the right side (fig. 9).

When the superficial parallel bowstring muscles of the body were weakened or paralyzed, the convexity of the spine was directed toward the weakened side (figs. 6, 8 and 10). If the right external intercostal muscles

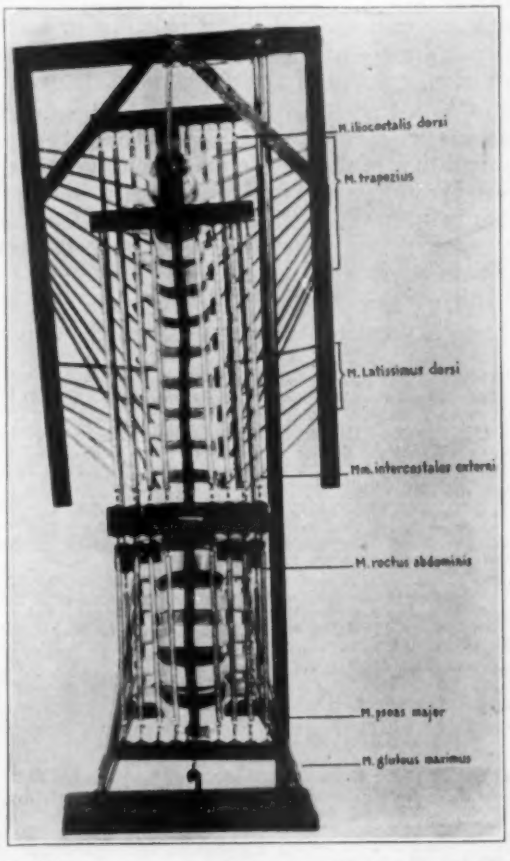


FIG. 2.—VENTRAL ASPECT OF THE DYNAMIC MUSCLE-BONE BALANCE MODEL OF THE HUMAN SPINE (ABOUT ONE-FIFTH NATURAL SIZE). THE SPINE HAS NO DIRECT SOLID SUPPORT BUT IS SUSPENDED IN A BACKPRESSURE FIELD WHICH IS A RESULTANT OF THE BILATERALLY BALANCED SPRING TENSIONS. THE BLACK ELASTIC BAND EXTENDING VERTICALLY OVER THE MIDVENTRAL ASPECT OF THE BODIES OF THE VERTEBRAE REPRESENTS THE MIDDLE LONGITUDINAL LIGAMENT.

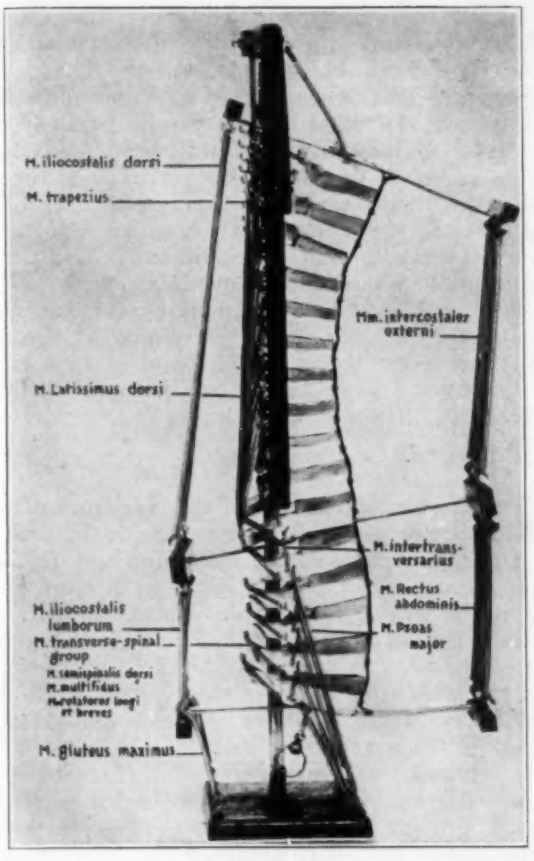


FIG. 3.—LATERAL ASPECT OF THE DYNAMIC MUSCLE-BONE BALANCE MODEL OF THE HUMAN SPINE (ABOUT ONE-FIFTH NATURAL SIZE.) THE SPINE HAS NO DIRECT SOLID SUPPORT BUT IS SUSPENDED IN A BACKPRESSURE FIELD PRODUCED BY THE BILATERALLY BALANCED TENSIONS OF STEEL WIRE SPRINGS. THE VENTRAL CONCAVITY IN THE THORACIC AND THE VENTRAL CONVEXITY IN THE LUMBAR REGIONS ARE PRODUCED BY DIFFERENTIAL TENSIONS OF THE STEEL WIRE SPRINGS. THE TRANSVERSE WOODEN BARS REPRESENT THE UPPER AND LOWER LIMITS OF THE THORACIC CAGE AND THE PELVIS, THE PUBIS VENTRAD AND THE SACRUM, ILIUM AND ISCHIUM DORSAD. THE VENTRAL CONVEXITY OF THE LUMBAR REGION OF THE SPINE IS THE RESULT OF THE TWO MUSCULAR FORCES, (1) THE BOWSPRING EFFECT OF TWO POWERFUL MUSCLES, THE SACROSPINALES AND THEIR SYNERGISTS, AND (2) THE VENTRAL TRACTION OF THE PSOAS MAJORES. THE VENTRAL CONVEXITY OF THE CERVICAL VERTEBRAE IS LIKEWISE A RESULT OF THE BOWSTRING MUSCLES OF THE BACK OF THE NECK. THE LUMBAR AND CERVICAL COMPENSATORY CURVES ARE DEVELOPED WITH THE INCREASE OF POWER OF THE DORSAL SPINAL EXTENSOR MUSCULATURE IN MAINTAINING THE SPINE ERECT. THE CERVICAL CONVEXITY DEVELOPS FROM THREE TO SIX MONTHS AFTER BIRTH WHEN THE HEAD IS FLEXED AND MAINTAINED IN THE UPRIGHT EXTENDED POSITION WHEN THE CHILD BEGINS TO SIT UNAIDED. THE LUMBAR CURVE DEVELOPS FROM NINE TO TWELVE MONTHS AFTER BIRTH WITH THE ABILITY OF THE GROWING CHILD TO SIT, STAND AND WALK WITH THE SPINE VERTICALLY PLACED.

or the rectus abdominis muscle was weakened or paralyzed, those on the left side acted as a bowstring and forced the convexity of the spine to the opposite or right side (figs. 6 and 10). The convexity of the spine was directed to the left side when the left iliocostalis dorsi muscle was paralyzed. This was due to the unopposed action of the right parallel bowstring muscles (fig. 8).

When the right intertransversarii and the right transversospinal muscles were weakened or paralyzed the unopposed action of the muscle group of the left side caused a right convex scoliosis with a rotation of the bodies of the vertebrae to the side of the convexity (figs. 11, 12 and 13). In this case, convex-sided torsion of the bodies of the vertebrae was a resultant of the imbalanced action of the deep torsion muscles of the spine.

Definite torsion of the vertebral column and relatively little lateral displacement were produced when the transversospinal muscles were unilaterally weakened or paralyzed (figs. 14, 15, 16 and 17). By the elimination of the action of the superficial muscles of the body, the pure effect of the deep torsion muscles was demonstrated. By releasing the action of the right transverso-spinal muscles, the unopposed action of the left ones rotated the bodies of the spine to the opposite or toward the right side (figs. 14 and 15). The reverse effect was produced when the left transversospinal muscles were released from action. The overacting right transversospinal muscles rotated the bodies to the opposite or to the left side (figs. 15 and 16). The bodies of the vertebrae may be made to rotate toward the side of the convexity or toward the concavity of the curvature, depending on which side the intertransversarii were paralyzed. The lateral deviation of the spine and concave and convex-sided torsion of the bodies of the vertebrae were resultants of the imbalanced actions of different combinations of the muscle groups of the body.

There are numerous possible combinations of muscular imbalance. With only thirteen pairs of spinal muscles there are more than sixty-seven million possible combinations of muscular imbalances resolved by the mathematical formula $(2^n—1)$. There are 144 muscles directly attached to the movable spine. The mind is unable to conceive the result of multiplying out to the one hundred and forty-fourth power: $2\times1=2$ (second power) $\times2=4$ (third power) $\times2=8$, and so on to the one hundred and forty-fourth power.

Different groups of imbalanced muscles may produce the same type of spinal curvature. The clinician meets

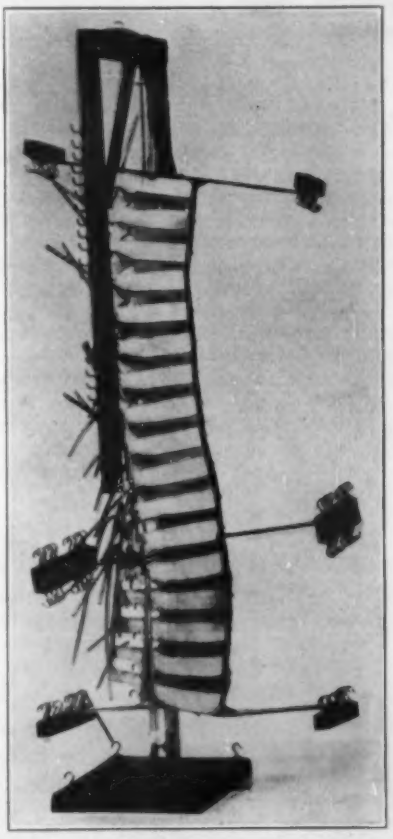
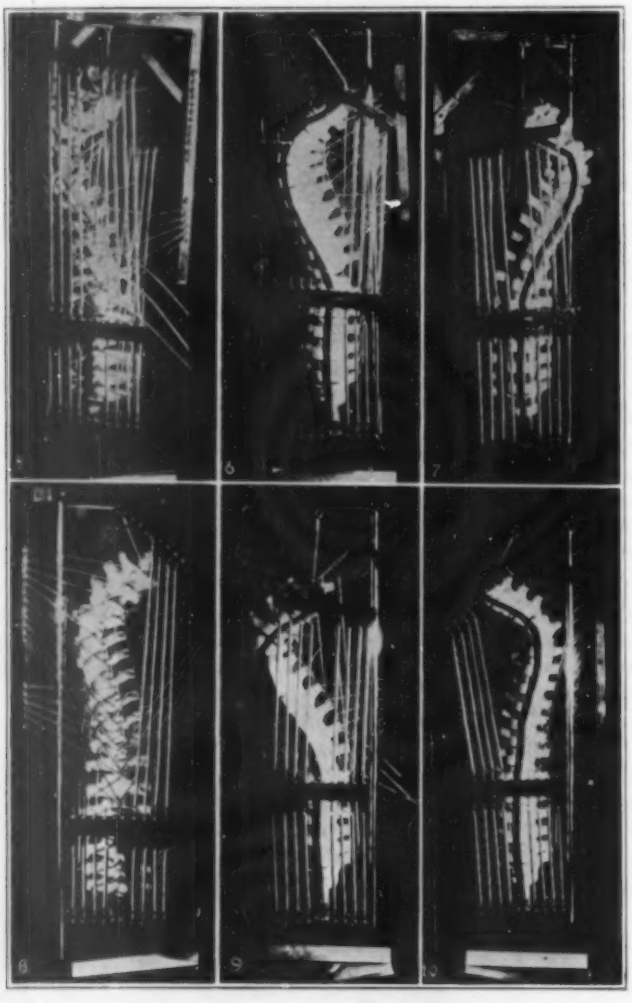


FIG. 4.—VENTROLATERAL ASPECT OF THE DYNAMIC MUSCLE-BONE BALANCE MODEL OF THE HUMAN SPINE (ABOUT ONE-FIFTH NATURAL SIZE). THE SPINE IS STRIPPED OF ALL TENSIONS OF THE STEEL SPRINGS AND THE MECHANICAL RESULTANT OF THE BACKPRESSURE OF SPRING PULL.



FIGS. 5 TO 10.—DORSAL AND VENTRAL ASPECTS OF THE DYNAMIC MUSCLE-BONE BALANCE MODEL OF THE HUMAN SPINE (ONE-TWELFTH NATURAL SIZE). THE LEFT LATERAL SCOLIOSIS IS PRODUCED BY THE RELEASE OF THE SPRINGS ON THE RIGHT SIDE WHICH REPRESENT THE TRAPEZIUS MUSCLE (FIG. 5). THE RIGHT LATERAL SCOLIOSIS IN THE DORSAL REGION IS PRODUCED BY THE RELEASE OF THE SPRINGS ON THE RIGHT SIDE WHICH REPRESENT THE RIGHT EXTERNAL INTERCOSTAL MUSCLES (FIG. 6). THE LEFT LATERAL SCOLIOSIS IN THE DORSAL REGION IS PRODUCED BY THE RELEASE OF THE SPRINGS WHICH REPRESENT THE RIGHT TRAPEZIUS MUSCLE (FIG. 7). THE LEFT LATERAL SCOLIOSIS IN THE DORSAL REGION IS PRODUCED BY THE RELEASE OF THE SPRINGS ON THE LEFT SIDE WHICH REPRESENT THE LEFT ILIOCOSTALIS DORSI MUSCLE (FIG. 8). THE RIGHT LATERAL SCOLIOSIS IN THE DORSAL REGION IS PRODUCED BY THE RELEASE OF THE SPRINGS ON THE LEFT SIDE WHICH REPRESENT THE LEFT TRAPEZIUS MUSCLE (FIG. 9). THE LEFT LATERAL SCOLIOSIS IN THE DORSAL REGION IS PRODUCED BY THE RELEASE OF THE SPRINGS ON THE LEFT SIDE WHICH REPRESENT THE LEFT EXTERNAL INTERCOSTAL MUSCLES (FIG. 10).

a definite practical difficulty, therefore, when he tries to assign to any single muscle group or combination of muscle groups the cause of a specific curvature of the spine.

PREVENTION

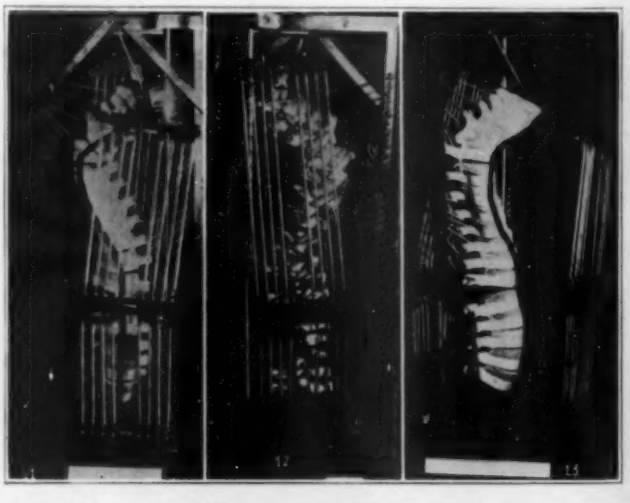
Any agent that upsets the normal dynamic equilibrium of the motor system of the back will be evident in the spinal indicator of muscle balance and imbalance. The motor system of the back is maintained in normal balance by the functional integrity of the blood, nerves, muscles, tendons, bones and joints. These six anatomic phases form a physiologic system of motion. During the first decade of life, even under apparently normal conditions there is found by Baker[37] an undernourishment in 25.2 per cent of school children before 10 years of age. This results in a dystrophy of muscle and bone growth. The dominant muscular atrophy is focal and asymmetrical. This dissociation of muscular and skeletal growth is more dominant in girls than in boys.

This focal muscular atrophy and paralysis of undernutrition will upset the muscle-bone balance of the normal spine and may well be the insidious cause of idiopathic scoliosis. The problem of scoliosis is then a problem of prevention of all conditions that upset the normal balance of muscle and bone during growth. This has been proved by Müller[8] and myself[30] on experimental animals in the production and prevention of myogenic scoliosis. Steindler[41] has a similar point of view in preventing structural scoliosis by the elimination of those generalized debilitating conditions that he designates prescoliosis.

CONCLUSIONS

1. Scoliosis is a spinal sign of the imbalance of muscle and bone growth of the motor system of the back and is not a specific disease entity. The kind and degree of scoliosis are dependent on the extent of the imbalance, caused by the weakening and possible paralysis of multiple combinations and permutations of the muscle groups of the body as a whole. Accurate anatomic and physiologic knowledge of the motor system of the back as a functional whole is necessary for an understanding of pathologic changes in the spine.

2. In chronic infantile inanition and malnutrition there is a decrease in muscle weight and a persistence in skeletal growth in length. The muscles do not degenerate uniformly. This asymmetrical focal muscular atrophy and localized muscular weakness or paralysis of the undernourished child are more pronounced in girls than in boys. This results in unequal pull on the spine and the striking of an abnormal muscle-bone balance. This inequality of muscular atrophy and paralysis upsets the normal dynamic equilibrium of the muscle and bone growth of the spine. Chronic underfeeding or malnutrition of the child during the first decade of life is, therefore, suggested as the insidious cause of idiopathic structural scoliosis.



FIGS. 11 TO 13.—VENTRAL, DORSAL AND LATERAL ASPECTS OF THE DYNAMIC MUSCLE-BONE BALANCE MODEL OF THE HUMAN SPINE (ABOUT ONE-TWELFTH NATURAL SIZE). THIS RIGHT LATERAL SCOLIOSIS IN THE DORSAL REGION HAS A SUPERIMPOSED CONVEX-SIDED ROTATION OF THE BODIES OF THE VERTEBRAE. THIS DEFORMITY IS PRODUCED BY THE RELEASE OF THE SPRINGS ON THE RIGHT SIDE WHICH REPRESENT THE RIGHT INTERTRANSVERSARII AND THE RIGHT TRANSVERSOSPINAL MUSCLES OF THE DORSAL REGION. WHEN THE BALANCE OF THE DEEP TORSION MUSCLES OF THE SPINE IS UPSET THERE IS LIKEWISE A TENDENCY OF IMBALANCED ACTION OF THE SUPERFICIAL SPINAL MUSCLES.

3. The convexity of the laterally deviated spine may be toward either the stronger or the weaker muscle side.

4. The convexity is toward the weak muscle side when the parallel bowstring muscles are dominantly weakened on the side of the convexity of the primary curve of the scoliotic spine.

5. The convexity is toward the strong muscle side when the superficial transverse-traction-torsion muscles are dominantly weakened on the side of the concavity of the scoliosis.

6. There is a definite lateral deviation of the spine with relatively slight rotation of the bodies of the vertebrae when the large superficial muscles of the body are dominantly imbalanced.

7. There is definite rotation or torsion of the spine with relatively slight lateral displacement when the deep intrinsic muscles of the spine are dominantly imbalanced.

8. In clinical practice there are all combinations of imbalance involving eventually both the superficial and the deep intrinsic muscles of the spine where scoliosis is found.

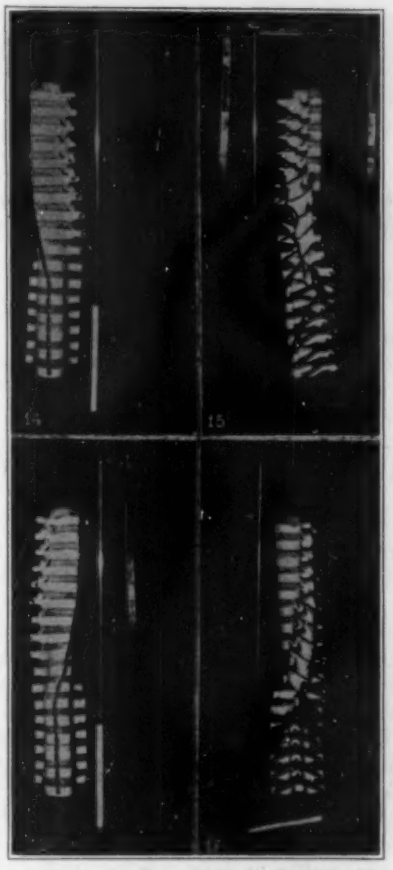
9. Concave and convex sided rotations of the bodies of the vertebrae are resultants of the imbalance of different groups of muscles of the body as a whole.

10. These facts have been proved experimentally on animals and are demonstrated on the muscle-bone-balance model of the human spine, which visualizes the normal and abnormal dynamic equilibrium of the bilateral body muscles, recorded in the spinal indicator.

11. The problem of scoliosis is, therefore, fundamentally one of prevention of all conditions which upset the normal dynamic balance of muscle and bone during the period of growth, such as chronic inanition and malnutrition, and the various types of chronic diseases, which lead to undernourishment of the growing child.

12. During growth and maturity the components of the motor system of the back differentiate and function as a physiologic, interactive whole and not as a mere mosaic of passive, autonomic and independent anatomic parts. This dynamic point of view is opposed to the static one, which holds that the bone of the spine or any other bone in the body is originated and maintained independent of environment.

1848 Fourth Street.



FIGS. 14 TO 17.—VENTRAL AND DORSAL ASPECTS OF THE DYNAMIC MUSCLE-BONE BALANCE MODEL OF THE HUMAN SPINE (ONE-TWELFTH NATURAL SIZE). THE SPRINGS THAT REPRESENT THE SUPERFICIAL MUSCLES ACTING ON THE SPINE ARE STRIPPED FROM THE MODEL. THE INTERTRANSVERSARII AND THE TRANSVERSOSPINAL MUSCLES ARE RETAINED. MARKED TORSION IS PRODUCED WITH RELATIVELY LITTLE LATERAL DEVIATION OF THE SPINE WHEN THERE IS IMBALANCED ACTION OF THESE DEEP TORSION MUSCLES. THE BODIES OF THE VERTEBRAE ROTATE TO THE RIGHT WHEN THE RIGHT TRANSVERSOSPINAL MUSCLES (SPRINGS) ARE RELEASED FROM ACTION (FIGS. 14 AND 15). THE BODIES OF THE VERTEBRAE ROTATE TO THE LEFT WHEN THE SPRINGS THAT REPRESENT THE LEFT TRANSVERSOSPINAL MUSCLES ARE RELEASED FROM ACTION IN THE DORSAL REGION (FIGS. 16 AND 17). WHEN THE INTERTRANSVERSARII ACT ON ONE SIDE THERE IS A SLIGHT BOWSPRING EFFECT WITH THE CONVEXITY OF THE SPINE DIRECTED TO THE OPPOSITE SIDE.

Physiotherapy in Poliomyelitis

By Theodore E. Orr, M.D.

It is interesting to note the trend of thought in recent writings as to the etiology of poliomyelitis. Many feel it is a generalized infection involving the lymphoid tissue and that paralysis is a complication affecting only a very small percentage. Figures vary with different authors, the average however being in the neighborhood of 13.5%. It has also been pointed out where only one child is stricken, in a family of several children, the others escape probably due to the fact that they have had a slight attack which was not recognized or that they were immune at that particular time.

The chief role of Physiotherapy in Poliomyelitis is the prevention of deformities and restoration of function of affected parts.

During the acute stage it is often impossible to determine the extent of the paralysis, nevertheless that does not excuse us from keeping the affected extremity in the best possible position for future function; so that the affected muscles are not over-powered by the unaffected ones. Paralysis in Poliomyelitis is rather characteristic as certain groups of muscles are more frequently involved than others. For instance, in the arm the deltoid frequently remains paralyzed while other muscles recover in full or in part. This is also true of the quadriceps, anterior and posterior tibials, and peronei of the lower extremity. Bearing this in mind, we may be on our guard for the protection of these muscles. Incidentally, it is important to note how many of the recent cases involve the upper extremity. Probably the most simple method of fixation is by the use of plaster of

Paris. Casts may be used but prolonged application is to be avoided, as muscle atrophy is surprisingly rapid when incased in a solid plaster cast. Therefore, we prefer plaster moulded splints. These may be easily applied to conform to the individual extremity, and can be placed in any desired position. They are light in weight and can be readily removed. During the acute stage too much emphasis cannot be placed on the value of rest. Avoid fatigue by too active massage, electrical treatment and manipulation. During the acute stage rest and application of heat is all that is necessary. At the end of the febrile period carefully supervised, graded massage and exercises may be instituted. If muscle pain and tenderness persist, the massage should be light, a stroking motion with gentle passive exercise. A very effective way to begin early massage is by use of the whirlpool. This is a tank in which the affected limb is submerged in warm water (90 degrees). The swirl of the water produces a gentle massage effect equally applied under even pressure. When the pain and tenderness has completely disappeared, deeper manual massage may be instituted with safety as well as active exercise. Galvanism is also frequently used but its use should be carefully guarded for fatigue may be readily produced during the early stages. Diathermy is another method of application of heat and is preferred by many as they feel they obtain a deeper penetration of heat. When the extremity is capable of function guarded exercise with the affected part submerged in warm water is very helpful. As Archimedes pointed out, the body is as much lighter in water as the volume of fluid it displaces. Many muscles having slight innervation left in them but which are apparently useless, can be, under skilled direction, exercised to their maximum power when submerged in water. Swimming is often possible with children who have extensive paralysis of the lower extremities as is evidenced every year by the children of the Widener Memorial School. Many of these children walk with aid of braces and crutches and are badly crippled, yet they are expert swimmers and I have known them to swim for an hour or longer without rest. Daily exercise and muscle training may be successfully carried out in special gymnasiums with various appliances adapted to the function of the various muscle groups under treatment. A great deal of skill in the supervision of these exercises is necessary so that the unaffected muscles do not assume the entire function of the affected ones, thereby missing the object of the treatment which is to try to develop the function of the damaged muscle. There are instances however in which we have total paralysis of a certain group of muscles where hope for return of power is useless. In these cases it becomes necessary to develop re-establishment of muscle balance by throwing a part of the work of the affected muscles on the unaffected muscles of similar function. It is desirable, when possible, to separate the poliomyelitis patients from others during gymnasium work to preserve their morale. We are enabled by segregation to equalize competition. In this way also bashful or backward patients are stimulated to their fullest extent. In the care of very young children we should keep these exercises from becoming irksome and probably the best way to accomplish this is to turn exercise into play.

Elaborate gymnastic appliances are not absolutely essential, for with knowledge of the function of the affected muscles exercise may be given to stimulate function, as for instance, in cases of partial involvement of the quadriceps the patient may at first be only able to swing the leg and not hold it against gravity but as function improves the patient is then able to hold the leg against gravity and finally to move the leg against resistance, regulated by the physiotherapist.

To summarize: first, it is most important to prevent deformity; second, physiotherapy is a great aid in the treatment of poliomyelitis but its application should be guarded; third, fatigue must be avoided; fourth, treatment should be rendered under the guidance of skilled physiotherapists; fifth, elaborate gymnastic apparatus is not necessarily essential.

1930 Chestnut St., Philadelphia, Pa.

Convalescent Serum in the Treatment of Poliomyelitis

By W. D. Stovall, M.D.

Presented at the Poliomyelitis Clinic, Madison, before the convention of the A. P. A., June 29, 1932

Because of its high incidence among young children and because of the defective state of our knowledge about it, there is probably no disease which produces such a high state of fear and feeling of helplessness among the people in general and the doctors in particular as does poliomyelitis. This explains the susceptibility of the people to extravagant claims for various quack treatments and the readiness with which physicians resort to any treatment for which any scientific background can be shown.

The scientific background for convalescent serum was laid in the experimental work of Landsteiner and Popper and Flexner and Lewis. Their experiments showed that a characteristic poliomyelitis could be produced in monkeys by the injection of mascerated cord from patients who died of this disease; and further, that the disease could be transferred from monkey to monkey by this process.

The next phase in the experimental investigation was introduced in 1910 by Flexner, Lewis, Landsteiner, Levadili and others when they showed that blood serum from monkeys recovered from poliomyelitis would prevent the disease in those animals injected with virus which had been first mixed with the serum. They secured a virulent cord emulsion from a monkey which had died of the disease and mixed some of this emulsion with monkey convalescent serum. This mixture was then injected into well monkeys. They did not contract the disease. This is undisputed evidence that monkey convalescent serum will destroy the infectious nature of the virus for monkeys.

This was the scientific background which suggested the possibility of the successful use of convalescent serum in human cases of poliomyelitis. Nutter in France in 1915 was the first to make use of this method of therapy and although a fourth of his patients died, the report on his experience was suggestive and therefore encouraging. Zingher in 1916 suggested the im-

portance of administering the serum early in the course of the disease. He treated fifty-four patients in the pre-paralytic stage by giving intraspinal injections of convalescent serum. Forty-four of his patients so treated recovered without paralysis, five developed severe paralysis and five slight paralysis. Acock and Luther in 1928 reported the use of convalescent serum in 106 cases of poliomyelitis in the pre-paralytic stage. They believed that the result of their experience indicated that the serum had benefited their patients.

Then came the summer of 1931. By July 1st there had been reported thirty-five cases in New York City and a few cases out in the State. For the week ending July 25, 155 cases were reported from the Borough of Brooklyn and 47 cases from the State. In Wisconsin there was reported two cases in June, in July thirty-six and in August one hundred seventy-two. By the middle of July the whole country was in a state of fright. With the scientific background and the clinical experience quoted above state and municipal health departments turned to convalescent serum as a treatment for pre-paralytic cases. New York secured blood from their Governor and many others. In Wisconsin the State Board of Health sent out letters to all physicians requesting that they send to Madison for bleeding all patients who had recovered from poliomyelitis within the last three years. The State of Wisconsin General Hospital paid these donors twenty-five dollars for 500 cubic centimeters of blood from which we recovered approximately 250 c.c. of serum. The bleeding was done by the hospital staff and the State Laboratory of Hygiene prepared and acted as custodian of the serum. We could exercise no control over its distribution; as long as there was any on hand we answered all requests. We distributed six hundred and seventy-nine treatments. What the dosage should be was more or less arbitrarily determined but in most places where it had been previously used, 50 c.c. was recommended with a repetition of this dose in twenty-four hours if the patient was not improved. This we adopted with the recommendation that it be given either intraspinal, intravenous or intramuscular, and that it be used only in pre-paralytic cases. The intramuscular method of inoculation was used almost entirely especially in the rural districts.

We gained no clinical information from our use of convalescent serum. There was no attempt made to control its distribution. Many cases that were not poliomyelitis received serum treatment. This could not be prevented since the pre-paralytic symptomatology of poliomyelitis is often that of many other acute infections and laboratory facilities were not available in sections remote from hospital centers. These patients, of course, recovered without paralysis.

However, during the 1931 outbreak in New York some carefully controlled groups of cases were treated with convalescent serum. Parke concluded from his experience that the observation of treated and untreated cases does not give any statistical proof that serum has any value after it can be diagnosed by cerebro-spinal fluid cell counts. He thinks that during another outbreak careful observation by experienced and impartial judges should be made of treated and untreated cases so that a final and correct opinion may be reached. The fact that Acock and Kramer had a similar experience adds emphasis to Parke's results.

As a result of last summer's experience and the work of Kramer and others there is now recognized a widespread immunity particularly among the adult population. This is explained on the basis of a much higher incidence of the disease than has been heretofore suspected. This was unsuspected since no pre-paralytic form was recognized until the epidemic of 1916 and it was therefore not recognized that many patients who suffer from the disease in its pre-paralytic form never go on to paralysis. Previously only the paralyzed patient was diagnosed as poliomyelitis. This explains why the serum treatment has at times, when based solely on uncontrolled clinical experience, seemed so successful. Kramer and others have shown that the serum from a large percent of the adult population, regardless of whether they have ever had poliomyelitis in a recognized form, will destroy the virus for monkeys just as described above for monkey convalescent serum.

The present status of convalescent serum therapy is that it is not yet proved that it has any value and in spite of the favorable laboratory experiments, the clinical results in treated and untreated cases is discouraging rather than encouraging.

Practical Experiences in the Application of Muscle Training in the After-care of Poliomyelitis

By Marion Ballantyne, R.N.—Orthopedic Supervisor Winifred Johnston Hearn, B.S.—Consultant Visiting Nurse Association of Brooklyn

PART II

In Part I the writers cited practical suggestions for the examination and the muscle re-education for the lower extremities. This article will follow the same plan for the upper extremities, back and abdomen.

The patient should assume the supine position if any of the muscles cannot function against gravity.

Care should be taken that there is no distortion of the trunk when an effort is made to complete the arc of motion.

1. *Abduction of the humerus to the horizontal*—Raising the arm sideward.

   Exercise—Same as test.

   N.B.—(1) If the deltoid has little or no power and the operator must give assistance when the patient is abducting the arm there are certain points to remember.

   (a) Eliminate the rotation of the scapula by holding it in place with the free hand.
   (b) Flex the elbow in order to place the weight nearer the acting force.
   (c) Have palmar surface of hand toward medial line of body. (This places the entire extremity in a more useful position.)

   (2) If abduction is to be performed with elbow extended have dorsal surface of arm lead in the

movement. Thus the action occurs without assistance from the biceps.

2. *Flexion of humerus to the horizontal*—Raising the arm forward to the shoulder level.
   Exercise—Same as test.
   N.B.—Same points to be considered as in abduction to the horizontal. If muscle does not function against gravity have patiem assume sidelying position on unaffected side.
3. *Hyperextension of humerus*—Drawing the arm backward.
   Exercise—Same as test.
   N.B.—Same points considered as under "2."
4. *Flexion of humerus above horizontal*—Raising arm forward and upward.
   Exercise—Same as test.
   N.B.—Though it is generally known that the position of sidelying is used when it is necessary to eliminate gravity nevertheless this position does not seem advisable. For not only is it awkward but it produces strain on the muscles surrounding the shoulder and tends to increase sub-luxation of the humerus. Therefore it is suggested that the patient be placed in the supine position, clasp hands and then raise arms forward and upward, though assistance may be necessary.
5. *Abduction of humerus above the horizontal*—In the sitting position raise the arm sideward, upward.
   Exercise—Same as test.
   N.B.—(1) Patient in supine position if muscles cannot function against gravity.
   (2) Care should be taken that head remains in neutral position.
6. *Adduction of the humerus*—Lowering arm from abduction.
   Exercise—Same as test.
   N.B.—If abductors of humerus are weak do not complete the arc of motion.
7. *Elevators of shoulders*—Shrugging shoulders.
   Exercise—Same as test.
   N.B.—Head should remain in neutral position. There is a tendency for the head to be drawn to the shoulders.
8. *Depressors of the shoulder*—With elbows extended push arms downward.
   Exercise—Same as test.
   N.B.—The ability to perform this activity is an extremely important factor if it is necessary for the patient to use crutches.
9. *External rotation of humerus*—With arms abducted to the horizontal position, elbows flexed and forearms resting downward on the table, rotate the humerus outward.
   Exercise—Same as test.
   N.B.—Guard against elevation of the back and shoulder.
10. *Internal rotation of the humerus*—Same position only forearms are resting on table in opposite position (above shoulder).
    Exercise—Same as test.
    N.B.—Advice the same as for "9."
11. *Flexion of elbow*—In the supine position the humerus abducted and the arm resting on the table, flex the elbow by moving forearm over the surface of the table.
    Exercise—Same as test.
    N.B.—The forearm should remain in supination.
12. *Extension of the elbow*—Position the same as in "11" for test and exercise.
    N.B.—The same as in "11."
    If the test is given against gravity careful observation should be made that the triceps are actually functioning and that it is not the controlled relaxation of the biceps that is preventing the forearm from dropping.
13. *Supination of the forearm*—With entire arm resting on the table, humerus abducted, elbow slightly flexed and palm resting on the table, turn palm upward.
    Exercise—Same as test.
    N.B.—The suggestion of the flexion of the elbow is made in order to prevent any assistance from the external rotators of the humerus.
14. *Pronation of the forearm*—With entire arm resting on the table. Humerus abducted, elbow slightly flexed and dorsal surface of hand resting on table, turn palm downward.
    Exercise—Same as test.
    N.B.—Same as for "13"—the movement being performed by the internal rotators.
15. *Flexion of the Wrist*—With the ulna side of the arm resting on the table bend the hand toward the anterior surface of the forearm.
    Exercise—Same as test.
    N.B.—If the hand is held in any abnormal position this should be corrected while performing the exercise.
16. *Extension of the wrist*—Same position as in "15" then bend the hand toward the posterior surface of the forearm.
    Exercise—Same as test.
    N.B.—Same as for "15."
17. *Abduction of the hand*—With the forearm and palm resting on the table bend hand to ulna side of the forearm.
    Exercise—Same as test.
    N.B.—(a) If ulna deviation is present it is advisable to eliminate this exercise.
    (b) If there is some deformity present in the hand it should be held in the corrected position during the exercise.
18. *Adduction of the hand*—Same position as in "17" then bend the hand toward the radial side of the forearm.
    Exercise—Same as test.
    N.B.—(a) Care should be taken that the hand returns to the medial line of the arm.
    (b) Same as "17" "b." Any deformity at the wrist should be held in the corrected position during the exercising of the fingers.
19. *Flexion of the fingers*—Make a fist.
    Exercise—Same as test.
    N.B.—(a) If the oppenens pollicis is weak it may be necessary to assist the thumb in order to form a normal fist.
    (b) It may be necessary also to give assistance at the metacarpal-phalangeal joint in order to make a fist.
20. *Extension of the fingers*—Extend the fingers until they are in a straight line with the dorsum of the hand.
    Exercise—Same as test.
    N.B.—If there is a hyperextension at the metacarpal-phalangeal joints these joints should be held in a corrected position while the fingers are being extended.

21. *Abduction and Adduction of the fingers and thumb*—Position of hand and arm the same—Spread and close the fingers and thumb.

Exercise—Same as test.

N.B.—Guard against undue hyperextension at any joint.

22. *Opposition of the thumb*—With the palm of the hand facing the patient touch the tip of the little finger and the tip of the thumb.

Exercise—Same as test.

N.B.—(a) The motion of the thumb must occur at the base of that member and not be localized to flexion in the first and second phalangeal joints. In the little finger flexion should occur only in the metacarpal joint.

(b) In this movement it is considered important that the patient is able to see what he is doing. Therefore the effect of gravity on the part has not been considered.

23. *Trunk raising*—From the supine position, with arms crossed over chest and with legs held on table by operator the patient raises his trunk to the sitting position.

Exercise—Same as test.

N.B.—This is an extremely difficult exercise from the standpoint of coordination and pounds of work done. Therefore it should be eliminated from the program of a patient suffering from weak abdominal muscles until that condition returns almost to normal.

For example: If this exercise is done before the patient is capable of correct performance assistance must be given. This is usually done by pulling on his arms, as a general rule he leans forward making the back and shoulders very round. Then, the pelvis usually tilts downward creating a lordosis. Furthermore all muscles usually become too tense thus producing a lack of coordination.

No exercise should be performed if there is any strain or tenseness during the execution of it.

ABDOMEN—If leg exercises are given with their primary purpose being that of strengthening the abdominal muscles it should be remembered that to attain this end the pelvis must be the fixed point and the legs must move in unison.

For example: With the patient in the hook-lying position, double knee upbending is done and *both* thighs are flexed on the abdomen.

If the exercise is performed by *alternate* thigh flexion on the abdomen the movement is not primarily an abdominal exercise.

In the performance of this exercise "double knee upbending" if the patient tends to raise the back from the table (tilt the pelvis downward) he should be taught to keep the back flat or his position changed to that of side-lying. Then have him do double knee upbending. The line of the back must also be flat when in this position.

N. B.—(a) Lordosis is increased if the pelvis is tilted.

(b) Back muscles are used which should be eliminated and the abdominal muscles are stretched.
(c) The patient obtains an incorrect idea of the position of the pelvis in relation to the other parts of the skeleton.

All abdominal exercises should be disassociated from the function of breathing.

For example: In the hook-lying position the patient contracts the abdominal muscles and the chest remains at rest.

N.B.—(a) The knees are flexed in order to prevent undue pull on abdominal muscles and to keep the pelvis in the correct position.

(b) The contraction is done smoothly and slowly in the region just above the pubic bones in order to prevent the contraction occurring solely in a line just below the ribs. The chest remains motionless. The movement is small.

It seems wise to discourage any exercise which causes a distention of the abdominal muscles as that stretches muscles that are weak. It may also give a wrong impression of the position of the abdomen in the upright position.

The upper fibers of the abdomen may be exercised by having the patient raise his head when in the hook-lying position.

When massaging the abdomen the patient should be in the hook-lying position. As stated earlier this position prevents strain on the abdominal muscles.

There are many other movements that involve the use of the abdominal muscles which have not been analyzed here. As a general thing the same observations made on the above exercises pertain to all abdominal exercises.

BACK—At this time the re-education of the back muscles is being considered only from the standpoint of general bilateral weakness due to paralysis. Any unilateral deviation or so termed scoliosis is not being included.

With the paralysis of one or both arms the back should be carefully watched.

24. *Test for the Back*—Prone lying with arms at the sides, raise the head and shoulders off the table.

Exercise—Same as test.

N.B.—(a) This movement should be localized to movement in the thoracic region, otherwise the movement involves hyperextension of the lumbar spine which increases lordosis. With the movement centered in the thoracic region the movement of necessity must occur in a limited range.
(b) The arms should be externally rotated as they extend along the sides of the trunk in order to decrease the tendency of rounding the shoulders as would occur if the arms were internally rotated.

There are many exercises which require the bilateral function of the back muscles which are not discussed here. Because, in order to obtain the best results one must learn to carefully analyze the particular needs of each patient and re-arrange and adjust activities to fit those needs.

The principle of approximating the origin and the insertion of weak muscles must be kept in mind when considering the re-education of the back and the abdominal muscles.

For example: If the abdominal muscles or the hip flexors are weak it does not seem advisable for the patient to do the exercise under "24" if the back muscles need re-educating. Therefore the exercises for increasing the strength of the back muscles must be considered in relation to the condition of the antagonistic groups.

Electrical Testing of Muscle and Nerve Irritability

By Walter J. Meek and Frank Maresh

From the Department of Physiology, University of Wisconsin Medical School. Presented at the Poliomyelitis Clinic, Madison, before the convention of the A. P. A., June 29, 1932

A knowledge of the way in which normal nerves and muscles respond to electrical stimulation has proved of value in studying pathological conditions of these tissues. Ordinarily the stimuli reach the muscle through its nerves, but if these be injured the muscle may be stimulated directly. It is not the place here to discuss the whole subject of electrodiagnosis. Enough to say that in pathological conditions we may bring about a response, or qualitative variations in the character of the response, or a combination of these two types of reaction. These changes from the normal may be detected by stimulating the nerves and muscles with galvanic or faradic currents which now give the so-called reaction of degeneration. In partial degeneration the nerves show a decrease of both faradic and galvanic response. Muscle shows a decreased faradic excitability but at first a heightened galvanic response. The positive pole may be more effective than the negative and the contraction sluggish. In full degeneration the nerve is entirely inexcitable. The muscle still responds to galvanic stimuli but the current strength must be greater and the contraction is sluggish and slow. The polar formula is usually changed and the motor point is displaced peripherially.

These simple galvanic and faradic tests are by no means as easy to apply as one might think at first glance. They are also insufficient for exact measurement of the irritabilities and the degrees of change. Physiologists have therefore developed condenser methods which allow very accurate quantitative measurements. Stimulation depends on strength of current and duration of flow. The capacity of the condenser determines the time of discharge, or duration of stimulation. If the condensers are charged with twice the voltage necessary to get a minimal galvanic contraction, the time necessary to stimulate may be very accurately determined by finding the condenser that just brings about contraction. This time is the chronaxie. The chronaxie increases with degeneration and decreases with recovery. It enables one to chart the course of events in a quantitative fashion, and is therefore an improved method of studying the course of nerve and muscle lesions.

It must be emphasized that muscle and nerve testing is not a technique that can be carried out easily or hastily. It requires patience and repeated observations. If carefully done it yields, however, valuable diagnostic and prognotic information. No one has yet compared chronaxie findings with a very large series of clinical cases, a study much needed. It seems that an application of these methods may indicate with considerable accuracy whether muscle and nerve are growing better or worse, or whether they have reached the stage of absolute degeneration. Such information may be useful in determining the value of the physiotherapy methods, the length of time they need be employed, and if there is no improvement, the time at which surgery becomes advisable.

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The Convalescent Care of Heart Disease in Children

By John Huston, M.D.

Any consideration of adequate care during the convalescent stage of cardiac disease cannot be arbitrarily separated from the management of the other stages of cardiac infection. The ultimate solution of this problem is intimately interrelated with a successful fight against "rheumatic" infections. This is inevitable, because the vast majority of heart disease in childhood is "rheumatic" in origin and to date no universally applicable measures have been discovered, which will prevent the development of rheumatic disease, or satisfactorily eliminate its ravaging complications, once they have developed.

Rheumatic heart disease is the result of the unfortunate cardiac localization of a chronic inflammatory process of protean manifestations. It is a fallacy to assume that all cases with rheumatic symptoms will develop rheumatic heart disease. What the factors are that predispose an individual to cardiac involvement or determine the duration and extent of cardiac damage, remain a mystery at this time. Constitutional tendencies, climatic conditions, standards of living, general health and the inevitable focal infections, all play a part in the individual response, and each of these factors must be carefully assayed in every case.

If we could prevent rheumatic infection, there would be no necessity for the convalescent care of cardiac disease in children. Are there any preventive measures which can be relied upon? Unfortunately conclusive statistics are not available, but certain observations are of considerable interest. It has been shown by comparative surveys that the incidence of rheumatic heart disease is decidedly less in the warmer climates. Other studies seem to indicate some familial predisposition to the disease, but this tendency may be partly hereditary and partly the inevitable result of close association and cross infection with the same pathogenic organisms. The old problem of focal infection in tonsils, adenoids, and teeth, remains as troublesome as ever. Mass studies in this field favor somewhat those advocating removal of focal infection, preferably before manifestations of rheumatic disease have appeared. Finally, better care during debilitating childhood illnesses and other measures which will improve the general body tone are undoubtedly important factors in the preventive attack on rheumatic disease.

In the unfortunate group that develops evidence of rheumatic heart involvement, a struggle is precipitated which will influence the balance of the child's life.

Many variable factors may affect the progress of the conflict and in dealing with them patience achieves its greatest reward. Under these circumstances "Time is the great healer" and the reparative activities of Nature will not be hurried. Complete rest is an imperative necessity until all evidence of cardiac infection has subsided, and this must be succeeded by a still longer period of judicious supervision and management of the child's activity.

It is during this period that the problems of convalescent management become most troublesome. Provisions for adequate convalescent care of all types of disease have not developed in proportion to other medical facilities. Considering sickness as a whole, we are adequately supplied with hospital accommodations, but with few exceptions, hospitals are geared for the treatment of a relatively short illness. Considerable progress has been made in the chronic care of the tuberculous and of certain nervous and mental disturbances. The devastating effects of infantile paralysis and the solicitude naturally given to crippled children in general, have awakened a wide spread interest in their proper care and in many communities the children crippled with heart disease have been included in the provisions for better treatment given these other unfortunates.

It is very evident that children threatened with various degrees of disability from rheumatic heart disease, should receive special consideration. This solicitude should not be limited to the period of acute illness. Of necessity, they must receive competent medical supervision, with proper hospital care during the acute and subacute stages of the disease. This medical supervision must be continued and supplemented by social supervision during the period of school training. This should include adequate vocational direction and opportunities for rehabilitation as changes occur in their condition.

Energy and money expended for the proper care of the early stages of cardiac disease will prevent the inevitably larger expenditures which follow inadequate treatment with its resultant more advanced degrees of disability. A growing general appreciation of this problem is evident within the medical profession, among hospital authorities, social agencies and even more strikingly among the laity itself.

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Back Pain

By John Allen Talbot, M.D.

Paper read at the Pathological Clinic on November 3, 1931

The road of least resistance was certainly not selected when I decided to present a paper to this Society on "Back Pain." The etiology alone could be spread upon many pages.

A symptom that is of interest to all of us as physicians, surgeons, and specialists and upon which several schools of the healing art have been founded deserves certainly an important place and much more careful consideration than is usually accorded "Back Pain." I think we are too prone to minimize the importance of back ache and we make a hurried examination or none at all in our usual routine physical examinations. We can all remember when back ache was cataloged as lumbago and later still, every individual suffering back pain was told he had a sacro iliac strain. With our present knowledge, lumbago perse is a rather rare condition and sacro-iliac strains are far less common than supposed. The anatomical structure of the spine is in itself an important etiological factor in back pain.

A column of vertebrae, each vertebra placed one above the other and separated by introvertebral cartalaginous discs or shock absorbers and articulating one with the other by two facets, the whole structure between the cage of the thorax and the pelvis being supported only by muscle and ligaments is in itself somewhat unstable. A rather mobile structure is the spine, capable of flexion and extension, lateral motions and rotation. Is it no wonder then that a group of joints used and misused many times a day in the natural course of events should show the result of strain and stress.

The many pathological conditions in the spine capable of producing back pain are certainly far remote from so-called lumbago of a few years ago. I know of no medical or surgical problem that is more difficult to diagnose and to relieve than is back pain. A straight clear history is absolutely essential. It should include all important data and especially any serious or trivial injuries which the individual might have suffered. Examination of the spine should be made carefully and with a very definite object in mind, with a clear understanding of what each and every objective sign means. Referred pain in the extremities, abdomen, chest and even the throat, often mislead one unless a fairly careful examination of the spine is done. Inspection alone will determine poor posture, the presence or absence of kyphosis, lordosis, scoliosis and other deviations from the normal. Palpation will elicit points of tenderness on deep and superficial pressure, presence or absence of muscle spasm and confirms irregularities seen on inspection. Active and passive motions of the back show much. Note carefully the limitations from the normal. Passive motions are valuable in children. Motions of the spine should be noted with the patient standing, sitting, and in the prone position. Tracings of the outline of the spinous processes are especially useful in children as a check for later comparison. X-ray should by all means be taken as an aid in examinations and should include in many instances the whole spine and in at least two views, the anterior posterior, and the lateral. In obscure conditions, neurological examinations are necessary, including spinal fluid examination.

Etiology: The causes of back pain should be considered under the following headings:

1. Injuries
   a. Severe, producing fracturers, fracture-dislocations of one or more vertebrae or of the sacro-iliac joints.
2. Infections
   a. Infectious arthritis from focal points elsewhere
   b. Neisserian
   c. Tuberculosis, especially in children
   d. Syphilis
3. Congenital anomalies
4. Metabolic

a. Hypertrophic osteoarthritis
5. Metastatic, secondary to involvement elsewhere. Prostate, uterous and breast.
6. Static, imperfect posture, residual poliomyelitis, ideopathic scoliosis, rickets, flat feet.

Another and distinct cause of back pain has recently entered the field. Our older text books spoke of railroad spine or traumatic neurosis. Today it is better termed compensation psychosis. Moderate lowback strains with symptoms prolonged beyond all reason because the individual is receiving something without working. These patients form a large group in industry. Exaggeration of subjective symptoms out of all proportion to the objective signs, usually are encountered and aid in diagnosing this class of case.

Severe injury producing fracture-dislocations of one or more vertebrae with or without spinal-cord involvement does not come within the scope of this paper. The same may be said of fracture-dislocation of one or both sacro-iliac joints. I cannot, however, leave this type injury without a word of caution as to prognosis. We have reduced quite a number of fracture-dislocations of the sacro-iliac joints, applied spica casts, given doubtful prognosis only to see these individuals make a complete recovery with little or no permanent disability. This type of case makes one wonder why so many patients with so-called sacro-iliac subluxation should have so much pain, in the absence of definite arthritis of this joint. Compression fractures of one or more vertebrae frequently produced by a fall on the buttocks are of frequent occurrence. History of the injury, muscle spasm, limited motions of the spine with pain the outstanding symptom, should lead one to suspect this type of injury. X-ray clears the diagnosis. Fracture of the transverse and spinal processes with or without displacement of the fragments are very common, the former more frequently seen. Here again, the manner in which the individual receives the injury is a help in diagnosis, for instance, a direct blow or fall upon a sharp object such as the edge of a step. The outstanding symptom is pain with very definite localized tenderness immediately over the site of the fracture. This is confirmed by X-ray.

Under the heading of injuries come next the most frequent causes of back pain, strains of the lumbo-sacral or sacro-iliac joints, or frequently very definite subluxation especially in the lumbar-sacral articulation. After examining many backs for pain, I have come to a very definite conclusion. The lumbo-sacral joint is by far the most frequent offending joint. This joint is potentially the cause of much difficulty. The fifth lumbar, the largest of the vertebrae articulates with the sacrum by facets that are often asymmetrical, and many times sacralized either on one or both sides. The normal angle of the joint predisposes to strain and should this angle be increased, the individual is more prone to symptoms. The joint is capable of flexion, extension and to some degree of rotation. Probably more motion occurs at this point than any other in the spine. The sacro-iliac joint, a true joint, is far better protected, is normally capable of some motion and does not bear the same degree of strain and stress as does the lumbo-sacral. The differential diagnosis is often difficult, made more so at times, because both joints may be involved. Then too, infectious arthritis may develop in strained joints, prolonging symptoms and complicating the diagnosis. There are a few points of difference that can be brought out in our examinations.

Location of the tenderness, whether over the spine or over the region of the sacro-iliac joint. Increase of muscle spasm in lumbo-sacral lesion. Tenderness and pain over the sacro-iliac joint on compressing the pelvic crests. Tenderness over one side or the other, when with the patient on his back the affected leg is raised with knee extended. If pain is present on this manipulation, the Kernig sign is positive. Goldthwaite called attention to this and it sometimes bears his name in connection with back examinations.

In affection of the sacro-iliac joint, the spine involuntarily assumes a definite list or scoliosis, usually away from the side affected. Gait is guarded. The Gaenslen sign is useful in differentiating. The patient is brought well to the side of the table with the limb hanging free, the opposite knee and hip are flexed accutely to fix the pelvis. The free thigh is slowly hyperextended by the examiner with gradually increased force. The hyperextension of the hip exerts a rotative force on the corresponding path of the pelvis in the sagittal plane, through the transverse axis of the sacro-iliac joint. The pull is made through the y-ligament and the muscles attached to the anterior superior and anterior inferior spines of the ilium. As a result of impaired ligamentous support on the affected side, this rotation force causes abnormal mobility accompanied by pain either local or referred, on the side of the lesion. Referred pain is of little aid as in both conditions we find pain extending down the leg from the lumbo-sacral plexus.

The X-ray is of the greatest value in low-back conditions. It does not differentiate the strains but it is of help in picking up congenital anomalies of the fifth lumbar. It shows clearly the increase in the angle of the articulation of the fifth and discloses slight and very definite slipping forward of the fifth lumbar on the sacrum. The presence of spondylolisthesis at times only slight, is, I believe, the most frequent cause of back pain. In individuals occupied in heavy labor requiring lifting or prolonged strain of the back, show in a great number of instances a true spondylolisthesis. In the majority of cases the fifth lumbar slides forward on the sacrum. At times the fourth upon the fifth and occasionally however, the opposite is seen and there is a definite backward slip of the fifth or if you will, a forward slip of the sacrum.

Two conditions frequently met with and which in the light of our present knowledge should be considered under the head of trauma are Epiphysitis of the vertebrae or Schurman's disease (several of these were reported by me last year before this society) and Spondylitis d e f o r m a n s or Kummals disease. The former is noted in young growing individuals and the latter seen in older individuals coming on at times many weeks or months following an injury, and showing a gradual kyphosis of the dorsal spine with narrowing of the vertebral bodies.

Back pain from focal infections is frequently met with. Strains as a rule proceed the attack and because a definite history of injury is obtained, we are prone to overlook the presence of some focal infection in our long continued back disability cases. Teeth, tonsils, sinuses and at times intestinal tract are the usual location of possible infections. Long continued chronic prostatites and stubborn back pain, I find, often in the same individual. The rectal examination carried out routinally is of great benefit and much can be learned in so doing. The fact that the patient might have had syphilis should be kept in mind. A positive wasserman followed by appropriate treatment has cleared up many obscure conditions including back pain. While it is true that tuberculosis is found more often in children, still we must not overlook the fact that it does occur in older individuals. In children a back pain that continues for any length of time should put us on

our guard. Pain, stiffness with awkwardness and a dislike for play should arouse our suspicions. The lesion as a rule is in the anterior surface of the body of the vertebrae. An X-ray is of little value as an aid in the early diagnosis. It does show up very clearly however if destruction has taken place. Diagnosis should be made from the clinical picture.

CONGENITAL ANOMALIES

Under this heading we find defects of the fifth lumbar vertebra. Sacralization, unilateral or bilateral of the fifth lumbar is often noted in those patients with recurrent back pain. In many others there is a definite asymmetry in the articulating facets with the usual oval facet on one side and a flat or transverse facet on the other. Both of these conditions can be readily seen, will produce back strain. It has the same effect upon the spinal motions as a freely moving hinge and a rusty hinge has upon the movements of a door. An unusually high placed fifth lumbar produces a most unstable back and often seen along with this type, is an increase in the articulating ange with the sacrum. Unusually long transverse processes of the fifth impinging on the ilium are met with. In one case several years ago a very different joint had formed with the ilium and it was the site of a tuberculosis infection. One can readily see why unusually long lumbar spines that include a sixth vertebra should be potential for back strain. Some patients show a very definite spina bifida acculta of the lumbar-sacral spine and may be the cause of instability.

Metabolic diseases as seen in those of middle life and past and revealed by X-ray with the appearance of hypotrophic osteoarthritis are met with frequently. These patients complain of stiffness on arising from a sitting position. They are unable to flex or extend the spine, with most of the motion taking place in the hips. A tendency to overweight, arthritic changes in other joints, and recurrent attacks of acute disabling back pain. Many of these individuals go for years with little or no discomfort until some injury overtakes them. Then it is that they become markedly painful with almost complete disability. In a good many of these cases I have felt that very often the disability is due to an actual fracture of one or more of the osteo-arthritic spurs. The symptoms are so acute, the tenderness so often definitely local and the muscle spasm so pronounced that the picture is one we see in fractures of the transverse or spinous processes. In old hypotrophic arthritic spines that have existed for years there are not symptoms other than stiffness, the vertebrae being rather well fused.

Metastasis of the spine is not infrequently met with. In those patients who have undergone an operation for malignancy elsewhere, possibility of secondary infection in the skeleton should not be overlooked.

STATIC CONDITIONS

Poor posture, idiopathic scoliosis, ricketic scoliosis and residual poliomyelitis are all predisposing factors in back pain. Poor posture has for some years been considered the chief offending mechanical cause for low-back conditions. In young adults this is no doubt true but we must remember that in many the posture is secondary to some other condition that is the actual cause for low-back conditions or pain. True scoliosis whether idiopathic or the result of poliomyelitis or rickets is a potential cause for chronic strain upon the lower joint of the spine. In this connection, I sometimes wonder at the number of scoliotic spines of more or less severity that have never been suspected by the parents of the individual until attention is called to the curvature at the examination. It is necessary to differentiate structural scoliosis from that which is the direct result of some low-back strain or arthritis and also the list seen in sacro-iliac disease. The weak foot producing symptoms may be the factor in back pain and should receive attention and correction. Overweight individuals with large pendulous abdomens with poor distribution of the body weight unequal leg lengths following fractures or hip disease, all have a bearing. Strains of the low-back during pregnancy and at delivery are frequently met with. The functional disability noted in these women is often quite a serious problem. They all give about the same history with definite back symptoms aggravated by the routine care of the baby and gradually increasing to such an extent that only rest in bed gives relief. Many of these women have a tendency to put on weight and this often increases their symptoms. During the menstrual period, the pain is more marked. A little care during pregnancy and the delivery followed by an adequate support when these patients begin to get up and about will often prevent a definite degree of invalidism. The so-called gynecological back pain from pelvic inflammation, relaxed ligaments, producing retroversion, etc., are certainly met with. I am under the impression, however, that in more recent years my gynecological confreres are not operating upon them as frequently as formally when the backache is the only symptom.

Treatment: Under treatment we should consider carefully certain definite and important factors. Time will not permit me, nor do I believe it necessary to go into the detail treatment of the various conditions mentioned. A brief summary of treatment will be made of low-back strains, arthritic conditions, the most frequent causes of back pain. Is the condition acute or chronic? Have there been frequent recurrences? Has the individual been thoroughly studied where the condition is chronic? What occupation is followed, age, sex, stability of the patient's nervous system (many of these patients are markedly depressed and many unconsciously exaggerate their symptoms). Last but not least, is it a compensation case or a case which will probably enter the law courts? Rest, support, recumbency on a fracture bed that prevents sagging, heat and massage, corrective exercises are all indicated in acute strains in either the sacro-iliac or lumbo-sacral joint. Many persistent cases require besides rest, leg traction, plaster jackets and at times stretching of the sciatic nerve where pain is the outstanding symptom. Later still supports in the line of corsets, belts or braces, with physiotherapy. The arthritic cases should be thoroughly gone into for focal infection and this cleared up as soon as possible. The osteo-arthritis case requires more effective regulation of habits especially as to food and during acute flare-ups treated the same as the acute strains. Conservatism, I believe, is our best and conservative treatment should be persisted in for months before consideration of operative measures. Fusion operations upon the sacro-iliac joint or lumbo-sacral joint in selected cases after careful study, I believe, will give satisfactory results but the enthusiasm of some will I believe, react in time against promiscuous operative procedures. These patients with definite arthritis of the sacro-iliac joint with long continued or frequent recurrent attacks of pain should I believe, be considered for fusion. Spondylolisthesis, moderate or severe, asymmetry of the facets and sacralization of one side should also come under the catagory of cases to be considered. Support and the more conservative measures should be tried first and only when the symptoms are not alleviated and the earning capacity of the

individual is seriously impaired should operative measure be instituted.

CONCLUSIONS

1. A clear definite history is absolutely necessary in arriving at the cause of back pain.
2. Hypotrophic osteoarthritis is the basic idiological factor in the majority of our cases over forty years of age, even where history of trauma is found.
3. Lumbo-sacral strain with acute arthritis of this joint is probably as frequently found, if not more so than the same conditions in the sacro-iliac joint.
4. Congenital anomalies of the fifth lumbar are frequent, with improvement in X-ray technique and universal use of X-ray in low-back conditions, these anomalies are being discovered in a large percentage of our patients.
5. Referred pain occurs in low-back pain of both types (lumbo-sacral and sacro-iliac) and at times is difficult to account for. Bear in mind, sciatic pain in the great majority of cases is directly due to low back conditions.
6. Better and more careful routine examination of the spine.
7. A plea for conservatism in treatment.
8. Fusion operations in selected cases after full study.
9. The orthopedic surgeon should see these back cases before and not after they have gone the rounds of all the various cults in existence.

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Splints to Regain Function

By Mary Craise Thornhill

When a fracture has united and the splint or cast has been removed, the patient frequently finds that the most painful and discouraging period of his recovery is before him rather than behind, the period during which he regains the use of stiffened muscles and joints. It is then too, that he is turned over to the physiotherapist for treatment, if the surgeon is of that conservative group who will permit no massage or motion until the bone union is firm. If the fracture has been in a joint, or if there has been a straining and tearing of the joint when the fracture occurred in the shaft of one of the long bones, or if immobilization has been long, the return of function in the joint is apt to be slow and painful. Because of the pain it is frequently difficult to get complete active cooperation from the patient. Especially is this true of young children. Sometimes, where the patient is seen two or three times a week, in spite of most vigorous treatment, whatever seems to be gained one day, is lost by the time the patient returns for the next treatment. In industrial cases the disability is sometimes prolonged and causes great economic loss for the individual and his dependents.

In some of these cases the use of splints to supplement the active treatment has been very helpful. Metal splints have been bent with a hammer and pliers to the desired position, unless they were equipped with turnbuckles that made the desired adjustment possible. At an orthopedic shop they have had straps and buckles riveted on to make application easy and they have been padded with cotton and bandage to minimize their discomfort as far as possible. The patients are shown how to adjust the splint on themselves, or in the case of children, the parents are carefully instructed. They are told to use them daily at home and to bring them back frequently for readjustment as progress is made.

In this office the splints have been used more frequently for Colles fracture than any other kind. Where supination or pronation is limited, a splint that holds the elbow bent at right angles and extends to the base of the fingers is used. The hand and wrist portion is bent in the desired direction a little farther than the patient is able to turn his hand. Then after the arm has been strapped into the splint, the hand, with the dorsum against the splint and the palm exposed for supination, or palm down for pronation, is pulled over as far as the patient can tolerate, by the tightening of the straps across the hand. The patient is told to soak his hand and wrist in hot water for fifteen minutes and then to apply the splint and wear it for twenty minutes to half an hour twice a day. This prolonged moderate stretching has seemed to give excellent results. The wrist is usually too painful to make a longer wearing of the splint each day possible without increased swelling and tenderness. If hyperextension or flexion is markedly restricted, a simple cock-up splint is used, bent in the desired direction. The same patient may use both splints alternating them, so that each is used once a day.

In fractures of the elbow, or occurring near the elbow, complete extension is gained more rapidly by the use of splints. The splint is adjusted so that it is about five degrees straighter than the patient can extend his arm and then strapped or bandaged in place after the arm has been soaked in hot water. As the elbow is apt to be less painful than the wrist, it may be possible to wear the splint for two one hour periods a day, or even to sleep with it on at night. This has been especially helpful in straightening the elbows of young children.

When the tendoachilles is contracted it is difficult to get a very definite stretching with a foot splint, but if a right angle foot splint is worn at night, it supplements more active measures and prevents the pressure of covers and the relaxation of the flexors, undoing what has been gained.

An adjustable splint can be used on the posterior aspect of the leg to increase the amount of flexion of the knee, or an "airplane splint" to improve abduction of the shoulder after a fracture of the humerus.

Address at the Banquet, 11th Annual Convention in Milwaukee

By F. J. Gaenslen, M.D.

The medical profession has a high regard for your association and the work for which it stands, because of the growing appreciation of the results obtained in the rehabilitation of the disabled.

While many physicians have used physical therapy for a long period of time and have become thoroughly convinced of the benefits to be derived by the judicious use of the means at your disposal, a great service could be rendered the public if this appreciation of your work and of the possibilities within our reach could be still more widely spread.

My own interest in physiotherapy has been further stimulated since my participation in the work of the Council of Physical Therapy of the American Medical Association, of which Dr. Harry Mock of Chicago is chairman. This Council, as you may know, was created by the trustees of the A. M. A. on the suggestion of Dr. Joseph F. Smith of Wausau, Wis. Doctor Smith felt that the medical profession as well as the public was being exploited by some of the commercial interests, a great number of appliances being sold to the profession for use in various disorders and conditions, too often on the basis of extravagant claims set forth by fluent salesmen. The situation became so flagrant that it was comparable to the patent medicine scourge some decades ago. High pressure salesmen would demonstrate the products, laud their merits, and suggest in what conditions they might be used, not failing, of course, to add, more or less incidentally, that this additional equipment could be counted on to bring in a very handsome return to the physician. The question of diagnosis was not taken too seriously. Mysterious, high-priced, electrical appliances in mahogany cabinets became, in fact, the tail that wagged the dog, so that the term physiotherapy was apt to call to mind not heat, hydrotherapy, massage, and exercise, the body and backbone of physiotherapy, but the aforesaid pieces of ornamental furniture. All the so-called modalities received due consideration. This term "modality," which means nothing more than a form of treatment, I am glad to learn is being avoided by careful writers. More than this, commercial houses went directly to the public with their wares and sales campaigns, suggesting self-diagnosis and self-treatment. Witness the electrical horses, the reducers, the vibrators, the electric belts, and the red silk-lined caps with mysterious thermo-electric units to grow hair on bald heads. All these undesirable activities on the part of the manufacturers of apparatus, as well as of some members of the profession and of some of the cults, have had an influence much to be deprecated so far as the advancement of physiotherapy is concerned.

It is felt that interest has been too much centered on certain forms of electricity and ultra-violet radiation as compared to the much more widely applicable agencies such as heat, massage, and exercise. Well qualified physical therapists would not be without some of these newer forms of therapy but they realize that their field of usefulness is distinctly limited and when used should be used on a sound basis under the direction of skilled physicians and physiotherapists after careful study and accurate diagnosis of the condition as far as possible. When I say "newer methods" I have in mind especially diathermy and ultra-violet radiation. The value of light has long been recognized and is probably one of the oldest varieties of physiotherapy.

As a matter of fact, we know very little as yet concerning the biological effect of both light and electricity. We do know that ultra-violet light will prevent and cure rickets, and that it promotes the development of sound teeth and bones, but we have as yet no acceptable scientific evidence that it improves the general health and mental or physical tone. In this connection I should like to quote Edgar Mayer who states in the Handbook of Physical Therapy "serious workers will deplore the extravagant claims which have, from time to time, been made for the physio-therapeutic effectiveness of ultra-violet radiation, covering so many diseases that it is impossible to enumerate the entire list. It must be left to the future to substantiate or disprove reported favorable clinical results in conditions such as secondary and pernicious anaemias, nasal sinusitis, hay fever, common cold, catarrh, asthma, carbon monoxide poisoning, and many skin diseases."

Of the various forms of physical therapy, electricity is at present employed by the medical profession less frequently than almost any other type. The Galvanic and faradic currents are, of course, useful for diagnostic purposes, but in the rehabilitation of the injured and those suffering from various forms of paralysis, massage and muscle training are generally preferred.

A weakened muscle, of course, will respond to a suitable current, but the action is confined practically to a single segment in the neuro-muscular unit. The latter consists of the cortical brain cell, in which the impulse originates, the axone of the nerve cell, the lower motor neuron in the spinal cord with its cell and nerve fiber, and the muscle cell. The voluntary contraction, however feeble, calls every portion of this unit into play while the complicated nerve mechanism at the same time insures a relaxation of the antagonist since normal function presupposes not only contraction of the agonist, but relaxation of the antagonist. Not only that, but the inhibitory fibers, whose function it is to tone down the cortical impulses to secure a finely graduated movement, are also brought into action so that the unit functions as a whole. The advantage, therefore, lies clearly with voluntary motion although it must be conceded that in certain instances the electric current is of distinct value in preparing the way for muscle training later.

Turning from these at times very serviceable forms of treatment, we come to a consideration of massage, physical exercise, hydrotherapy, and occupational therapy, the really basic and most important agencies of physiotherapy. I am not going to try to tell you how to give massage because I am fully aware that I am talking to a group of experts who could tell me a good deal concerning the technique. But I will say a word about the indications and limitations. We are very prone to think of physiotherapy mainly in connection with injuries, such as sprains, fractures, and dislocations. But there is a large field in internal medicine for the physiotherapist, in which, I am sure,

his services will be more and more appreciated as time goes on. Doctor Pemberton, in a recent article, has again called attention to the need of physiotherapy in all conditions confining patients to bed for prolonged periods of time. Too often medical attention is centered exclusively on the particular organ or system which happens to be diseased. In practically all chronic diseases, and I would include pulmonary tuberculosis, chronic heart disease, and many others in which a patient is confined to bed for long periods, there must be a time during the convalescent period when it is safe and in the interest of the patient, to start him on graduated exercises and massage. Very frequently a patient on first being put on his feet after a long illness will experience dizziness and faintness. This proves that all the muscles of the body, the skeletal muscles as well as the heart muscle, are weakened. To hold the body in the upright position requires muscle strength; to pump the blood along a horizontal course requires very much less work than driving it in a vertical course. A very gradual resumption of the upright position, therefore is indicated, and this will be made still easier if, while in recumbency, carefully graduated exercises are instituted so that the heart may be slowly accustomed to resume its normal load. Backache and foot strain are very often observed due to the fact that sudden strain is put on muscles and ligaments which have been in the resting stage for a long period. Careful inspection of the body as a whole is indicated from time to time so that deformities, such as drop foot or flexion contracture of the knees, may be detected in their incipiency and corrected by passive exercises, putting the various joints through their normal range of motion as frequently as the condition of the patient warrants.

It will probably be conceded that gentle exercises of the extremities, will accomplish much in the way of gradually restoring the strength of muscles and ligaments to normal. We know that in chronic heart disease patients should be allowed to sit up only very gradually, the back rest being raised notch by notch as the condition justifies. I am sure that simple exercises, at first for hands and feet, later supplemented with exercises involving all four extremities and possibly the trunk, would speed up recovery very materially. Careful control of pulse and respiration is an important guide. Such exercises may be repeated frequently, a definite schedule being worked out for the individual patient. Later graduated resistance exercises may be outlined. I am sure that such exercises in the recumbent position are less tiring than sitting up with a back rest.

Further advantages lie in the fact that these exercises can be instituted before the patient is released from strict recumbency and that the patient is much less likely to over-tax his strength since he can rest as frequently as he desires between individual efforts. The mild fatigue produced in this manner will increase the appetite and promote healthful sleep with less likelihood of the need of narcotics and cathartics. A little reflection, I am sure, will convince anyone that these considerations are sound and that physiotherapy is not used nearly as much as it should be, or as it ultimately will be, in internal medicine.

While the question of diagnosis rests on the referring physician the possibility of error, even in the best hands, must always be kept in mind, so that if progress is delayed cases may be referred back for further observation. Every now and then we see patients who have been receiving a prolonged course of diathermy for, let us say, low back pain when the difficulty lies in faulty body mechanics referable to flat feet, to occupational strain, or to a focus of infection. A painful shoulder may be due to firm adhesions which no amount of heat or passive or active exercises will remedy. I recall a patient not very long ago who, following a fracture of a shoulder, had developed contracture of the adductor muscles with a resulting limitation of abduction. She had received over a hundred diathermy treatments. Such errors will do nothing except bring disrepute to physiotherapy. Perseverance, of course, is a virtue, but action must always be based on sound premises. Then again, we must at times recognize defeat, or rather, the limitations of physiotherapy. I have in mind very resistent adhesions of the quadriceps muscle preventing flexion of the knee. If, after a reasonable period of physiotherapy, progress is absent, one should keep in mind surgical relief in the form of lengthening of the quadriceps tendon. In still other cases the stiffness is so marked that nothing short of an arthroplasty, or mobilization of the joint, will achieve the desired results.

Since physiotherapy must be regarded as a means of treatment, just as medicine, the dosage is important. This feature, however, I shall not touch on, especially before this audience, except to say that sins of overdosage are not forgiven as readily as those due to under-dosage and the consequences are frequently far reaching and harmful.

It has always seemed to me that *Rest* should receive a place, a dignified place, as a form of treatment. It is not simply the absence of active treatment, but the assiduous elimination of motion with the definite purpose in mind of complete immobilization. Combined with heat for the improvement of the circulation to the part, it is one of the most potent remedies we have in the combatting of acute infections of the soft parts. Let us assume that a patient has sustained a puncture wound of the hand with beginning infection. As long as the part remains at complete rest nature proceeds at once to wall off this infection, and local hyperemia results assisted by application of artificial heat. Leucocytes pour out and fibrin deposits occur which wall off the infection so that in a few hours the field of battle is restricted to a comparatively small area. If now the part is moved, the defensive barrier is broken down, the invading organisms are scattered about setting up new centers of inflammation in the neighborhood and the defense mechanism is called upon to lay new barriers to surround and limit the invaders. If these defenses are constantly broken down the defensive system collapses and a wide-spread and perhaps uncontrollable infection results. The same picture is presented in the tuberculous joint. If we could visualize a tuberculous lesion on a magnified scale we could see the tubercle bacilli walled off by a zone of protective cells until through some ill advised movement the partially cicatrized mass will be broken down, the organisms are scattered, new tubercles form, and an extension of the disease results. Thus it is easy to understand that sins of commission in such instances may lead to extension of a lesion to a point where not only the limb but the life of the patient may be jeopardized. No doubt you have all seen young children with advanced tuberculosis of a joint in which at some period, often at the hands of cultists of various types, manipulation has had tragic results.

In fractures, of course, rest of the fragments is absolutely necessary for the normal production of callus and the deposit of lime salts. If, during the healing process, the part is too frequently readjusted the callus has no chance for calcification and non-union results.

When the healing has finally occurred, changes have developed in the soft parts, as well as in the bone, due to disuse. The muscle cells are edematous and pale, the bone is more or less atrophied, waste products of metabolism have accumulated and nutrition of the part is generally at low ebb. The quartermaster of the body economy is very jealous of his supplies. A working part receives full rations but an idle muscle or an idle cell receives just enough to keep it alive. Here massage is of the greatest value in getting rid of oedema, in emptying the lymphatics, in carrying off waste products, and in stimulating the circulation.

I am in hearty accord with those who believe that the immobilization period should be reduced to the shortest period consistent with safety. We have, however, not infrequently observed disastrous results when too early weight bearing resulted in deformity or even in non-union. If we could immobilize the fracture site only, allowing normal or even moderate motion at the neighboring joints during the healing period, disability would be greatly reduced. But until such methods are developed, adequate fixation over a sufficient period of time is absolutely necessary and reliance must be placed on physical therapy to overcome the stiffness after the healing of the fracture is secured. Active and passive motion to stretch contracted parts to clear the right of way, however, must not be unduly delayed and any device which permits early use of these measures will be of distinct benefit. Sling suspension exercises in which the weight of the extremity is carried by a loop and cord from an overhead pulley with adequate protection of the fracture is of considerable value. Likewise, a rollerskate attached to the shoe, enabling the patient to carry out various motions at the knee and hip without strain on the injured site and with a minimum of effort. These devices practically eliminate the hindrance due to weight of the extremity so that the slightest muscle power may be translated into motion. Hydrotherapy is perhaps more valuable than any other agency although it requires trained personnel and very careful supervision. We are enthusiastic about the special tub for hospital use in securing early and safe motion in fractures. I feel sure that in some cases a potentially good result after a fracture of the neck of the femur is ruined by lack of proper splinting and protection during the early attempts at motion.

In the treatment of fractures I believe we must all avoid the tendency to think only of the fracture or even of the limb as a whole, without giving sufficient heed to the patient. This holds especially true for fractures of the lower extremity and particularly for fractures of the hip joint because of the necessarily long period in which weight bearing is prohibited. The mortality, years ago, was very considerable in the aged because treatment consisted largely of recumbency with sandbags to steady the limb. Because of pain on movement, the patient did not stir and hypostatic pneumonia and bed sores carried off a great many. With proper reduction of such a fracture and immobilization in plaster, the patient may now be turned and even put into the upright position with correspondingly better results, at least so far as mortality records are concerned. In certain clinics, of course, this consideration for the patient as a whole has received careful attention. I recall visiting the clinic of Professor Bardenheuer in Cologne in 1912, two years before the war. He had all his fracture cases in one ward and made it a rule that when he entered the ward all patients immediately started carrying out certain exercises, not for the fractured limb, but for the uninjured limbs for the purpose of keeping up their general muscle tone and nutrition as well as the functions of the heart and lungs. We are still too apt to forget that the body as a whole, suffers with the injury to the part, and that attention to these self-evident facts will do much to shorten convalescence, reduce the hospital stay and lighten the economic burden incidental to invalidism.

Chronic arthritis is an especially fruitful field for the physiotherapist. It is a pathetic sight to see some of these patients hunched up in bed or perhaps in wheel chairs, exemplifying every feature of bad posture, with the chest flat, the ribs depressed, the abdomen prominent and with flexion deformity in practically all the joints. Even a well person would feel disinclined, if forced to maintain this position for any length of time, to exert himself. The thoracic organs are crowded, there is visceroptosis with impaired digestion and sluggish bowels with resulting intoxication and the general body physiology at low ebb. It has been suggested that the ductless glands, upon whose activity our well-being depends in such a large measure, are unfavorably influenced in such conditions and that they form part of the vicious circle which can only lead the patient from bad to worse. While the ill effects of general faulty posture are quite evident, it is also evident that the posture of the individual part plays an all important role in prognosis so far as function of that part is concerned. A knee which is flexed to practically a right angle for any length of time results in contracture of the hamstring muscles and a stretching of the quadriceps. If continued, subluxation of the knee develops, and movement is soon within very narrow limits. Contractures of muscles, capsules and other soft structures occur, as after fractures or sprains, but in addition there is an intoxication and flooding of the soft parts with the toxins of the arthritic process itself. Here massage and gentle exercises, also postural correction, are of vital importance after correction of major deformity by suitable orthopaedic measures. It is entirely probable that the benefits derived from such treatment are to be explained not only on the basis of the preceding general considerations but on a specific reaction comparable to that seen in vaccine therapy. The tissues and fluids are probably laden with toxins, presumably in part at least, of bacterial origin. As the joint is moved, these toxins are forced into the surrounding tissues as well as into the general circulation. It is quite apparent that too vigorous action will flood the part as well as the general circulation with an excess of toxin with a resulting excessive general and local reaction. Excessive movement must therefore be avoided. Gentle manipulation and active and passive motion will, no doubt, often have the beneficial action comparable to the results obtained with careful vaccine therapy. In arthritis, also, the benefits of occupational therapy, called by someone the hand-maiden of physiotherapy, are often quite apparent. To my mind occupational therapy is especially useful in maintaining a correction obtained by other physiotherapeutic measures. Occupational therapy requires gentle voluntary action, largely within the pain-free range, rather than the extremes of motion which are obtained by forced passive motion.

I believe that the community workshop, well equipped and well staffed, serving a number of hospitals or perhaps the profession as a whole, has definite benefits not only from the standpoint of the patient but from the standpoint of education as well. The patient himself watches his progress with a keen interest. He follows the tracings showing the increased range of motion, and the steady progress is accepted

as proof that further progress may be expected from continued efforts. Being occupied in mind and body, he has less time to give to harrassing thoughts of impaired earning capacity and loss of station in our social organization. His morale is built up and we have in general a much more hopeful condition to deal with. We feel that occupational therapy is an important part of physical therapy.

Physical therapy is suggested and often demanded by insurance companies carrying financial responsibility in the rehabilitation program. Hospitals are providing equipment for the use of the various agencies of the physiotherapist and the profession as a whole is paying more and more attention to this field. It is only through the education of the members of the profession, who must be made more cognizant of the benefits to be derived, and through the close cooperation and interested and helpfully critical attitude that the best results will be accomplished.

Another hopeful sign of the times is the fact that the really responsible manufacturers have shown themselves in sympathy with the aims of the Council on Physical Therapy and that they are cooperating with the Council in every way. As far as others are concerned, you may be sure that a constant battle is in store.

I believe we have every reason to look into the future with assurance and confidence that physiotherapy will soon occupy the important place in the rehabilitation program which it so richly deserves.

425 East Wisconsin Avenue, Milwaukee, Wisconsin.

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EDITORIALS

The Passing of a Great Woman

With the going of Jane A. Neil on October the twenty-ninth, the crippled children of this country lost the most ardent and active friend they ever had. Yet they have lost only her physical presence; for the unflagging zeal and efforts of this remarkable woman have given to the handicapped child advantages which will continue and which will increase—a blessing to the child and a monument to herself. Her motto for the handicapped child was: "to give every child the best physical condition it is possible for him to attain; the best education it is possible for him to assimilate; and to help him find his place for service in the world's work."

With these aims ever before her, she served the crippled children in various capacities and with various ends in view.

In 1914 she became principal of the Spalding School for Crippled Children of the Chicago Board of Education, and in 1928 she was made District Superintendent over all the schools for crippled children. It was largely her untiring work and enthusiasm which helped build up in Chicago one of the best, if not the best systems of schools for the handicapped children in the world. It was also through her efforts that higher education was made possible for many children through cooperation with institutions of higher learning.

Aside from her work under the Board of Education, she was both active and influential in legislative work for the handicapped, especially in attaining state aid for the education of these children throughout Illinois. She was chairman of the sub-committee on Special Classes of the White House Conference on Child Health and Protection. For some time she was chairman of the Educational Committee of the International Society for Crippled Children, and with Franklin D. Roosevelt and Paul P. Harris, was honorary vice-president of this society.

Her interest in Physical Therapy was always keen. Again, it was her inspiration and through her efforts that Physical Therapy was made an important part of the work for crippled children in the Chicago schools; for by this means and with the cooperation of physicians and clinics, her first slogan is being carried out—"to give every child the best physical condition it is possible for him to attain." In recognition of her work for the handicapped and her interest in Physical Therapy, she was an honorary member of the American Physiotherapy Association, Chicago Chapter.

The American Physiotherapy Association, together with kindred fraternities realizes that ours is a period fraught with grave perils, but can face it with professional frankness rather than with the less scientific docile, make-believe optimism. This is not "painting the devil (of immediate universal catastrophy) on the wall" neither is it the popular infantile blindness, prone to lethargically peer at corners, just around which our misused and misplaced prosperity is said to await. What if we can not see quite the whole path to the next corner for the obstacles which we have flung in the way? But if we press on we will so charm the cripple that his at-present-paralyzed mechanism will enable his highness to step out from his obscurity and hold a more certain light for our journeyings.

Our pioneer ancestors braved the real perils of a primitive wilderness, our nation was conceived by a small handful of "minute-men" whose pluck broke the shackles

which bound us to tyrannical and fear-ridden Europe, and our unique therapy which can tone up old suffering prosperity in very definite and constructive ways, resulting in healthier people, better able to deal with their personal and social development.

Our own Lowell clothes the ideas in poetic beauty, "New occasions teach new duties," and calls upon us to do "the little more" of which Browning has so eloquently sung. Authorities need not be sighted, but the recent warning of the famous surgeon, Sir Wm. Lane, will show that the need for therapeutic mindedness is universal, and is a challenge to our professional pride and humanitarianism, "Modern civilization is being threatened by the ever-increasing tide of disease." This is not cheap publicity to attract patents to the offices of a charlatan, and it does not take into account the far reaching effects of our devastating but self-made world depression.

In addition to emphasizing the importance of each of us doing "the little more" in connection with our routine duties, it is well to realize anew the importance of making our activity in local, state, and national organizations. Just as our national welfare depends on the cooperation of well-organized and flourishing state units, with our national administration, so our chapter units are the foundation of our national association. Thus upon us as members scattered throughout our vast varied country devolves the responsibility of creating more active state chapters thus giving more force in making our National American Physiotherapy Association a more vital and representative organization. Each state chapter adds its own unique contributions to the advancement and usefulness of our national association; thus the many problems common to all states, as well as those peculiar to small groups secure the fullest attention through the facilities of our national organization. It is by means of this lively cooperation on the part of flourishing state chapters that important legislation promoting the general therapeutic welfare and conserving the high standard of our profession is introduced and sponsored.

Only members of the liveliest state chapters can know the fullest joy of most efficiently organizing their work, and seeing their cherished and tested ideas most widely accepted; all this quite in addition to the pleasures of fraternal fellowship, and the most satisfactory professional growth. Although long distances prevent many of us from knowing each other personally, contacts can be made and ideas exchanged by means of "round robin letters," state chapter periodicals, etc. The state chapters also provide members with efficient "clearing houses" for the interchange of social and professional amenities as well as for the interchange of practical personal experiences and hopes growing out of the skillful application of modern physiotherapy technique.

Here are a few suggestions touching "the little more and how much it is."

It would be quite superfluous to mention any "more" with regard to assignments of daily routine duties, but even in the stress of pressing work continued progress in professional advancement should not be lost sight of; if one is working too far from institutions, courses can be studied by correspondence, and for the higher university credits.

Perhaps there is a "little more" being done in one's neighboring state chapters, or some things are being done in different ways. The younger state chapters and those now being formed have certain definite advantages over those which were formed at an earlier date, in as much as the older ones have established practical precedents in the matter of organization routine, and the younger ones can profit by a consideration of the experiences of the maturer chapter organizations.

This is not meant to be fault-finding, but rather a hearty appreciation of past loyalty, of readiness to do "the little more" these trying times, and of more and more growing state chapters—may they increase and multiply!

L. E. B.

Attention East Coast, West Coast

Sectional meetings will be held early in 1933. You will be notified of exact dates by your local chairman. We urge you to attend these meetings. Here is your opportunity to participate in the activities of your organization and have a voice in the National Affairs.

The Revision of the National Constitution will be presented in order that you may discuss it before it is to be acted upon at the National Convention in June 1933.

There are times we would like to know where there is available material for exhibits, such as films, parts of films, photographs, charts, models of equipment and departments. Send information regarding such material to the National Secretary.

THE CHAPTER DIRECTORY is out of date. Please send in report immediately after election of officers and help us keep the directory up to date. Names of rejected applicants should be sent to the National Treasurer, Miss Mabel Holton, as well as the Membership Chairman, Miss Marian Sweezey.

DUES. The fiscal year for the Association is from July 1st to June 30th the following year. "DUES WERE PAYABLE LAST JULY FOR THE CURRENT YEAR." You are being allowed six months to pay your dues. Members who have not paid them by December 31 for the current year must be dropped from the mailing list. This means your REVIEW will be stopped. PLEASE PAY DUES NOW.

EXECUTIVE COMMITTEE.
(By Martha Hindman.)

Note: As this issue of the REVIEW goes to press an advance notice of the Eastern Sectional Convention announces that it will be held in New York sometime between March 15th and April 15th. This section includes Eastern New York, Western New York, Rhode Island, District of Columbia, Massachusetts, Pennsylvania, New Jersey—"and possibly Texas."

The District of Columbia Chapter

During the year 1931-32, the District of Columbia Chapter had seven meetings, November to April. The first was a business meeting solely. At the others papers were presented by some of the leading physicians and surgeons of Washington, on the following subjects: "Hyperpyrexia," "Experiences with Physiotherapy," "Arthritis," "Scoliosis," "Fractures," and "Mending Broken Personalities." These lectures were attended not only by the members of the Chapter, but also by students from the Army School of Physiotherapy at Walter Reed Hospital and the Students of Physiotherapy from the Washington School of Physical Education.

For the season just commencing, the program chairman has planned a series of lectures intended to broaden our contact with the field of medicine as a whole instead of dealing directly with physiotherapy. The October meeting was addressed by a woman physician who spoke of the welfare and social work being done among women and children in the District of Columbia. The next six months will bring us speakers on surgery, internal medicine, x-ray, nose and throat conditions, pediatrics, etc.

In Philadelphia since July 1st, there have been seven hundred and five cases of infantile paralysis, with 82 deaths.

The following Resolution was adopted at a Special Meeting of our Association:

"The Pennsylvania Physiotherapy Association offer their services to the proper authorities in this epidemic of Infantile Paralysis."

A list of the names and addresses of volunteers to be filed for reference when needed. At present the volunteers are busy.

L. A. W.

ERRATA: "Approved for publication by order of The Surgeon General, December 29, 1932, Washington, D. C.," on page 227 of the September-October number should have the date corrected to December 29, 1931.

The Wisconsin Chapter News

Since our last issue, our National Convention has come, has been seen, and has conquered, and now "belongs to the ages;" after which many members have enjoyed well-earned vacations. Much credit is due you for your support in making the convention a success.

Miss Mildred Jackobson and Miss Catherine O'Connor (secretary at the Junior League Curative Workshop), enjoyed a very exciting month in England and France—we wonder how many hearts were broken!

Some other returned vacationists have been able to report. Miss Elizabeth Jones spent hers at her home in central Wisconsin, while her co-partner, Miss Gertrude Bartlett, visited her home in Illinois. Miss Hattie Miller enjoyed a month's relaxation visiting friends throughout Wisconsin. Miss Evangeline Courtney inspected the beauties of the Pacific coast. Miss Dorothy Fox is still vacationing in Oneida, New York; we miss her very much.

Miss B. Claire Miller and her friend, Miss Lucie Spence (an O. T. student at the Milwaukee Downer College), vacationed in Nebraska, and our policy of economy alone restrains us from rapsodizing touching the superlative high spots of this state. We can but refer all who do not wish one chapter in their life to be quite blank, to these enthusiasts. But seriously, their experiences and pictures are very interesting and instructive.

Miss Mabel (Maridu!) Davis' return to duties in Eau Claire calls for a bit of stern official censure. In order that her flair for reparte may not confuse as to her proper name, ye editor hastens to diagnose the possible confusion as due to one of two circumstances or conditions, namely: (1) Her mis-applied eyesight (it really *is* M-a-b-e-l, and not "Maridu," really) or (2) Lucy's unique (!) script; but very likely, most emphatically the former.

Miss Lucy Blair spent her month in New Hampshire and renewed friendships in ye old town of Boston.

Mrs. Marguerite L. Ingram has been the welcome guest of several orthopedic schools since their opening in September.

The Lapham Park School has had a new addition in a section to be devoted to domestic science and manual training work. The Girl Scout group at this school is taking a very active part.

EDITORIALLY SPEAKING

When considering our progress and gradual recognition of our benevolent therapy on the part of authorities in allied fraternities and its slower acceptance by the public at large, we should keep in mind several phases of our present situation. A little reflection on medical history will remind us that our proper recognition and appreciation must result from our own personal faithfulness to daily routine duties, personal contributive research in professional fields, and a cheery readiness to give general instruction through whatever avenues of publicity open to us.

PHYSIOTHERAPY SURVEY

Names of Schools	Appleton	Eau Claire	Kenosha	La Crosse	Madison	Milwaukee	Sheboygan	West Allis	
TYPES OF CASES	NUMBER OF EACH								TOTAL
Treatment Cases	25	41	24	15	44	88	36	39	
Amputations						4			4
Anterior Poliomyelitis	11	12	5	9	23	43	8	12	123
Arthritis		1	1		1	1	1		5
Brachial Plexus Injury	1		2	3	1	2	1	4	14
Burns		1	1						2
Cardiacs		1	19	1	5	21		3	50
Chorea	2								2
Congenital Deformities	3	5	5	2	2	6	1	6	30
DEVELOPMENTAL CONDITIONS	1	1							2
Perthes Hip (Legg's D.)		1			1			2	4
Rickets			4						4
Diabetes Mellitus				1					1
Fractures						2		1	3
Goiter	1								1
Hydrocephalus						2			2
Ischemic Paralysis	1					1		1	3
Osteochondroma					1				1
Osteomyelitis		2	1		1	9	2	1	16
Post-Encephalitis					2		3	1	6
Post-Meningitis	1				2	1		3	7
Posture								1	1
Pseudo Hypertrophic Muscular Dystrophy				1		8	5		14
Scoliosis	1	4		3	2	5	6	1	22
Spastics	9	13	9	3	9	24	9	9	85
Spinal Bifida						4			4
Tuberculosis (Bone)	3		2	2	5	10		1	23
Tuberculosis (Contacts)								2	2
TOTALS (1932)	34	41	49	25	55	143	36	46	431
TOTALS (193)	30	42	44	29	45	120	27	44	382
PHYSIOTHERAPIST	L. Mitchell	M. Davis D. Hansman	B. C. Miller	L Holt	L. Borwell	E. Jones G. Bartlett	G. Johnson	E. Courtney	

We can be assured of our ultimate success by such an authority as The Council on Physical Therapy of the American Medical Association. In a recent volume "Handbook of Physical Therapy" we read: "During the World War the medical profession in general heard for the first time the terms, 'physical reconstruction and rehabilitation as applied to the human being.' Those of us close to this work—learned its usefulness and developed a great respect for real physical therapy—. However as a whole, the practicing medical profession was not adequately informed of the efficacy of these methods. Today it is gradually taking its place with the usual medical and surgical procedures. Physical therapy is at present in a transitional stage. Its use is extending, but it is still violently condemned in toto by some physicians. Experience indicates that a selected combination of physical measures offers the best results in certain pathologic conditions; in other conditions such measures serve as a beneficial adjunct to the usual medical and surgical treatment. Above all, continued treatment by physical means seems to result in better functional results than when patients are left to their own devices in securing restoration of function."

We present a very brief summary of what has transpired in the more public realms of our activities:

We try to touch but lightly on what makes us sad, and so we'll merely report the temporary abandonment of the Physiotherapy Department of the Milwaukee Children's Hospital, wishing most sincerely the very best of luck to Miss Marion Bremond in her new ventures.

We also try to properly emphasize the importance of doing extra-routine missionary publicity and instruction to the end that more may know more of our all-too-little-appreciated therapy.

Miss Mildred Elson has been giving valuable assistance to Dr. W. P. Blount in preparing material in the form of movies for his lecture on "The Orthopedic Treatment of Infantile Paralysis." Dr. Blount gave this lecture at the Tri-State Medical meeting held in Milwaukee during September. We shall look forward to hearing Dr. Blount and seeing Miss Elson's movie technique at the State Teachers' Convention next month.

Miss Borwell spoke at the Dane County Medical Association meeting in the St. Mary's Hospital in Madison on October 11. She spoke of the organization of the Madison Orthopedic School, dealing with some of its problems and achievements. Another speaker, Dr. Gance, gave a valuable lecture on poliomyelitis, summarizing a survey recently made in the East. The statistics tended to show a change in the use of convalescent serum.

Miss B. Claire Miller is continuing her missionary work. She gives talks on electro and hydro-therapy, exercise, and massage to the nurses of the Kenosha Hospital. She is also giving a series of talks to the teachers of the Kenosha Orthopedic School, discussing the patients as to etiology, manifestation, and treatment in physiotherapy; indicating what everyone can do to aid these handicaps.

Miss Lucy Blair continued her lectures in the technique of massage to the student nurses at the Milwaukee County Hospital, through the spring.

Miss Florence Phenix is still conducting the state survey; we feel very proud of the thoroughness with which this important service is being accomplished in Wisconsin, when we examine the statistics of other state surveys. She reports that during the last year four orthopedic clinics were held, in which 430 patients were examined from 34 counties.

At present the State Department of Public Instruction is in the process of organizing material for a bulletin. We shall be most interested to know the results.

Again at this time we wish to express appreciation for the increasing amount of work being done in our orthopedic schools. The education of the handicapped child must command a serious consideration in our public schools.

Bedside teaching is given to school children in Milwaukee. This privilege is extended to children in their homes, at the Milwaukee Children's Hospital and its convalescent home.

Abstracts

John S. Coulter, M.D.

The Role of Electricity in Treatment. E. P. Cumberbatch, B. M. Oxon., D. M. R. E., Camb., M. R. C. P. Medical Officer in charge of the Electrical Department, St. Bartholomew's Hospital; British Med. Jour., No. 3737, page 345, August 20, 1932.

Galvanic Current

Let us now consider the galvanic current and its role in treatment. What can it do and what can it do better than can other therapeutic agents? It can produce chemical caustics in the body, and these can be used for the destructive treatment of abnormal tissue. Treatment by electrically produced caustics is superior to treatment by ready made caustics in the following respects. The former can be produced within the tissues, the quantity made is under the precise control of the operator, the reaction is slight, and the cosmetic results excellent. The method, of course, has its limitations—only a very small amount of tissue can be destroyed at each application. But whoever the specialist is, and whatever his specialty, be he enthusiast or nihilist, I believe there is at any rate one abnormal condition in which he will admit that electricity has a role. I refer to hypertrichosis. But there are other maladies in which electro-medical cauterization is a more elegant method than the use of ready made caustics or the actual cautery—for example, stellate veins, telangiectases, simple papillomata of the skin, pedunculated warts, etc.

Ionization

There are various ways of introducing medicinal substances into the skin. The galvanic current is one of them. Since Professor Leduc introduced this form of treatment—ionization—at the beginning of the present century, there have been many hot discussions on the subject. It is now generally agreed that ions cannot be made to migrate more than a slight distance below the surface. But no method equals the galvanic when the operator desires to introduce ions into the skin, the accessible mucous membranes, the base of an ulcer, or the wall of a sinus. Within the range to which they can migrate the ions may almost be said to saturate the tissue. Compare this with the almost imperceptible depth to which the ions pass by the process of diffusion, when lotions or irrigating fluids are brought into contact with the surface. We may say, then, that the galvanic current is indicated when one desires to introduce therapeutic ions into the

superficial tissues to a depth beyond that which they can reach by diffusion. Compare the effects of irrigating the ear in a case of chronic suppurative otitis media with those following the immigration of zinc ions. Compare the results of packing the canal of the cervix uteri with antiseptics with those that follow the introduction of zinc ions.

The galvanic current possesses another therapeutic property, and I believe it to be of considerable value. I refer to its power to aid resolution of inflammation when progress by natural methods is stayed. This has been known since the middle of last century. I have in my possession a paper which was written by Leduc before he published his book on ionization. In this paper he describes the value of the galvanic current for the purpose I have just mentioned. It did not seem to attract much attention. But when the distinguished author made his investigations on ionization the attention of the profession was directed on the pharmacological properties of the ions rather than on the other actions of the current. Leduc's work on ionization came like a kindly light to lead us through the encircling gloom of galvanotherapy as it existed at the time. But we shall not be through the gloom until we know the action and method of action of the galvanic current on the deep as well as on the superficial tissues. Fortunately, some clinical investigation on this matter has been made in recent times. During the past few years it has been the custom at the Miller hospital to employ anodal galvanism in cases of Colles's fractures when there is undue pain and swelling. The treatment quickly relieves the pain, and the swelling subsides. Dr. C. B. Heald has had considerable experience on the use of anodal galvanism in cases of trauma.

THE SINUSOIDAL CURRENT

Before concluding I would like to say something—and ask something—about another current which has valuable therapeutic properties. I refer to the sinusoidal alternating current. It is potent in relieving pain in the later stages of neuritis. It is of high value in the treatment of the results of anterior poliomyelitis. It is not to be expected that the profession as a whole will consider these claims unless the method of action of the current is rationally explained. This explanation is still wanted. In the days when Lewis Jones was in charge of the electrical department at St. Bartholomew's Hospital, a very large number of cases of infantile paralysis were treated by sinusoidal current baths. Lewis Jones was the greatest English authority of his time on electrotherapy. In addition, he was a first class neurologist. He had the highest opinion of the value of the sinusoidal current in the disease under consideration. Yet today we get scarcely a single case for treatment in the department. Perhaps a change will come when we know more of the method of action of the current. The study of the effects of stimulation of the skin and its afferent nerve endings, not only by the sinusoidal current, but also by other electrical methods, such as the brush discharge, and the influence of this stimulation on the arterioles and the ductless glands, may well lead to findings of importance in the treatment of disease.

CONCLUSION

Finally, in discussing the immediate effects of electricity on the tissues rather than the therapeutic results that are brought about, I would say that the role of electricity in the treatment of disease is the following:

1. To heat the tissues which are beyond the reach of procuring (a) the medical effects of heat, and (b) the destructive effects, and, at the same time, the sealing of the microscopic vessels and the abolition of infection.
2. To cut tissue for surgical purposes, and at the same time seal the severed vessels.
3. To kill tissue by drying it, thereby causing a minimal reaction and producing the best possible scars.
4. To bring about the entry of therapeutic ions into the superficial tissues to a depth beyond the range of penetration by diffusion.
5. To kill tissue by producing chemical caustics within it.
6. Keeping in mind one of the physiological effects that electricity can bring about, we might add to the list: To procure vaso-dilatation and acceleration of the blood supply, and (probably in this way) to aid the resolution of inflammation.

The Mode of Action of the Diathermy Current. By Eric W. Frecker, M. R. C. P. (Edinburgh), M. B., Ch. M. (Sydney), Honorary Radiologist, New South Wales Masonic Hospital; Honorary Radiologist, Western Suburbs Hospital, New South Wales, in Med. Jour. of Australia, 11:9:259, August 27, 1932.

GENERAL EFFECTS

The general effects of heating the blood stream cannot be dismissed as of little significance. If heat is conceded to be a stimulant, the effect of warmed blood passing through the heart might reasonably be assumed to be a cardiac tonic and a general metabolic whip. Indeed, in the latter sense the current has been used to stimulate individuals with cold lethargic constitutions and even in hypothyroid cases. Crile has advocated the use of the current to raise the body temperature in surgical shock, diathermizing the liver from side to side, both before and after operation. In artificial diathermic fever recently introduced and specially applied to the treatment of general paralysis of the insane, use is made of the rise of body temperature, both to stimulate the immune reactions of the body and to destroy or restrain the spirochaete in situ by the direct action of heat. With adequate heat insulation and heavy currents passing for some hours through the whole trunk, body temperatures of 41° C. or more are attained. Currents up to 8,000 milliamperes have been employed.

Autocondensation has been extensively used for the treatment of high blood pressure and had the advocation of Clifford Allbutt. Considerable trial has convinced me of the benefits derived. Here again there is no necessity to call upon any other resources than those of heat to explain the results achieved. Considerable quantities of heat are introduced into the body with usually a small rise of temperature. Flushing, capillary dilatation and even sweating will occur. The chemical processes of the body are quickened with an increase in the solids in the urine. The heart muscle is stimulated and relaxation of the vascular periphery occurs, leading to a fall of blood pressure. This fall as a whole is usually temporary, but over a series of sessions there is, as a rule, a small net gain with considerable symtomatic improvement. It appears as if the redistribution of the vascular load, the tonic effect of the heat on the heart muscle and the metabolic stimulus interrupt a vicious circle, allowing the normal tendency to correction to exert its influence. Improvement for some months may ensue and the process may be repeated at intervals till at last organic changes become severe and this therapy fails in conjunction with all others.

On the hypothesis of vascular dilatation of the cardiac vessels and the relaxation of spasm, cardiodiathermy has been used at the National Heart Hospital, London, with promising results in cases of angina. The general heating of the blood stream probably plays a large part in the benefits obtained.

For the relief of spasm in general heat has always had

a reputation, and the deep heating effect of diathermy renders this heat therapy available in many conditions which superficial applications from the nature of things cannot reach. The application of through-and-through diathermy to patients with biliary and renal colic to aid the passage of a calculus (if passage is at all possible) is a reasonable therapeutic procedure, and its similar appliction to patients with spasmodic dysmenorrhea often affords relief.

Examples could be multiplied, but it is only necessary to realize that heat is the actual therapeutic instrument we use when we turn to the diathermy machine. The indications and contraindications will thereupon write themselves for us naturally. The machine itself is an elaborate tool used to produce deep-seated heat within the body by electrical means, but the basic principles on which the therapy rests were accepted before Hippocrates saw the light. They are tacitly accepted by every physician as he daily prescribes the ubiquitous and useful hot fomentation. The form changes, but the principle stands firm always.

In conclusion, it will be plainly seen from the foregoing that the diathermy current acts by normal physiological means and that therefore no miracles will occur through the manipulation of various switches in their due and proper order. Probably the most striking and speedy results are to be seen in purely traumatic conditions, in which healthy tissues seem to accelerate their repair markedly with the current. The repair of fractures seems a case in point. With chronic pathological lesions therapeutic efforts of any kind must be persevering and prolonged if relief is to be gained; and diathermy is no exception to this general rule.

SUMMARY

A review of some physical principles affecting the therapeutic uses of the diathermy current has been made with an attempt to justify all its effects on the basis of heat alone.

Diathermy in Obstinate Constipation. Violet M. H. Rendall, M. R. C. S., Eng., D. M. R. E. Camb., in Lancet, 11:6:284, Aug. 6, 1932.

Diathermy is hardly mentioned in English text books in connection with the treatment of constipation. In a debate on its influence in circulatory disturbances introduced by Professor Sidney Russ, in the Electrotherapeutic Department of the Royal Society of Medicine, Dr. Justina Wilson has alluded to its value in chronic constipation, and this appears to be the first mention of the treatment in that connection in England. Yet to many working in physiotherapeutics it must have occurred that the raising of deep temperatures and the production of local hyperaemias should be of practical value in certain of these cases.

Even if diathermy is considered merely as a heat producing agent, the atonic colon, sluggish, inactive, with poor musculature, should be benefited by increasing the circulation, bringing fresh blood through its walls, and removing congestion.

Turning to spastic colitis—heat is the best means of relaxing in muscular spasm, and, while relaxing the abnormal contractions, normal peristalsis can be encouraged by means of improving the blood supply.

In rectal dyschezia, where the normal impulse to defaecate is absent, rectal diathermy should prove a useful stimulus. I do not attempt to discuss the therapeutics in cases where the constipation is concurrent with some general disease or to refer to the varied methods, with purgatives, that have their successes and failures. It is intended only to put forward one form of electrical treatment, diathermy, given in association with massage and colonic irrigation. Permanent relief is obtained by this procedure in large classes of obstinate cases, while the accompanying massage is an important part of the technic.

The favorable reports from foreign authors led me to try the results of a course of sixteen diathermy treatments in a series of cases seen in a period of two years. A line of treatment practically common to all was adopted, and very little departed from; the electric treatment remained the same, the variations being in diet, massage and irrigation. The mode of life and the question of habit was investigated and a diet prescribed in accordance with the replies. The patient was examined to eliminate the possibility of the presence of some other disease of which the constipation might be a symptom. Septic foci in the teeth, the tonsils and nasal sinuses were searched for. The degree of auto-intoxication (if any) as manifested by symptoms was estimated as closely as circumstances permitted, and a bacteriological examination of the feces was made. It was endeavored by clinical examination to grade the patient under the classic varieties of constipation, and where consent was obtained an x-ray examination after a barium meal was made. As an approximate guide to the degree of stasis a cachet containing carmine dye was ordered to be taken at a certain hour, and the patient was instructed to note when the dye appeared in the motions.

Each patient had four diathermy treatments per week for four weeks. The treatment was administered by two large electrodes—one on the abdomen and one on the back. The amount of current given varied from 1500 milliamperes to 2500 milliamperes. This was continued for half an hour. The electrical treatment was preceded by twenty minutes abdominal massage and each patient had two colonic irrigations per week, directed towards ascertaining the condition of the bowel contents and removing accumulated faecal material.

The cases were picked from a group which has come under treatment during two years, where the constipation appeared to be the prime factor to be relieved. All who followed the course with perseverance were relieved in varying degrees. Those with very obstinate long standing constipation were on an average enabled to reduce their aperients to a third of the previous quantity, and the milder cases were able to discontinue them entirely. I should like to stress this point as the obvious criticism of the cases is that at the end of the course they were still taking aperients. It must be believed that the cases I have selected were the most obstinate and difficult cases.

In reply to those who maintain that all constipation can be cured by "rational treatment"—i. e., diet and improving the patient's mental attitude—I would point out that five out of the six cases quoted had already been treated on "rational" lines at some period or other before I saw them without the slightest result. There are many conflicting opinions as to the results of chronic constipation, and this would be expected, considering the variety of its causes and association, but it cannot be otherwise than harmful if left unrelieved. There may be justification for urging upon the patient the necessity of not dwelling too much on the condition, which undoubtedly rights itself sometimes without treatment after attention to diet and regulation of the mode of living. But when it does not, which is the commoner event, the physical trouble and the mental strain may be considerable. Therefore, any procedure that offers a good chance of relief, at any rate in certain groups of cases, should receive trial, if evidence of a promising sort is forthcoming.

The Treatment of Mental Disorders by Pyrexia Produced by Diathermy. C. B. Bamford, M. D., Liverp., Assistant Medical Officer, Rainhill Mental Hospital; Lancet (London) 11:7:337, August 13, 1932.

The high frequency currents generated by a diathermy instrument are passed into the patient's body by means of large flat metal electrodes, which are applied to the dorsal and ventral surfaces of the trunk and retained in position by a laced linen corslet. The patient's bed is prepared by spreading over the mattress a rubber sheet on which three blankets are placed well tucked in. The patient, lying on this, is covered with a blanket and another rubber sheet. Finally, more blankets are placed until about nine in all cover the patient, who is firmly tucked in all around to prevent all possible loss of heat. The transmission of high frequency currents through the body generates considerable body heat, and as this is not permitted to escape, the bodily temperature quickly rises. The temperature is taken at fifteen-minute intervals and carefully charted.

It is usually found that, at the end of three or four hours of uninterrupted application of the current, the temperature attains the neighborhood of 105 F, and at this point the electric power is shut off, but the arrangement of the bedding is not disturbed. The temperature, maintained for a short time, falls slowly at first, but after an hour the electrodes are removed and the temperature falls more sharply and reaches the normal level within four hours or so.

The treatment of patients was busily continued at this hospital until November, when a particularly restless patient, who had to be restrained by chemical means so as to allow the desired temperature to be reached, was found to be severely blistered on removal of the electrodes. In endeavoring to ascertain the cause of this casualty, it was thought that the electrodes had, through constant use, become defective, and, in view of this untoward experience, further treatment has been suspended, while the defect in the electrodes is being investigated by the Victor X-Ray Corporation, the manufacturers of the instrument. We are still at the time of writing, awaiting their report and recommendations and meanwhile have reverted to the use of malarial plus tryparsamide therapy.

Since the inception of this method twenty-one patients have been subjected to treatment. Of this number, thirteen have been cases of general paralysis, four of melancholia, and four of dementia praecox. In general paralytics a pyrexial course analogous to that of malaria was aimed at, and in a few instances achieved. Usually applications of current were given bi-weekly but occasionally—because of the great demands on the instrument (we only had one)—treatment was limited to weekly intervals. The only female patient, a very fatuous grandiose general paralytic was given pyrexial doses on alternate days, and the applications were continued until she had had sixteen elevations of temperature averaging 104.5 degrees. Six male cases of general paralysis received at least twelve pyrexial doses at an average temperature of 104.6 degrees, but in the remaining general paralytics treatment had to be restricted or discontinued for sundry reasons.

Beyond employing this treatment again tentatively, in suitable and selected cases of general paralysis, as soon as we are assured of a reasonably safe technic we are not encouraged to adopt diathermy in lieu of the methods already in use and in favor.

CONCLUSION

In conclusion, the advantages and disadvantages of diathermy may be summarized as follows:

Advantages.—(a) The pyrexia is under complete control throughout the treatment. Applications can be given at any time and to any number. (b) Prolonged treatment by this method does not produce physical prostration and weakness. (c) It is possible to give this mode of treatment to patients who are aged, marasmic, debilitated, or even affected with organic disease.

Disadvantages.—(a) It can only be administered with safety to patients who are quiet, restful and cooperative. (b) The great danger of burns due to motor restlessness seriously restricts the scope of the method. (c) There is no evidence in our experience to show that it is any more effective in producing a clinical remission than malaria.

The Roller Skate as an Aid to Active Motion and Muscle Training in Cases of Poliomyelitis. Nathan H. Rachlin, M. D., Brooklyn, New York, in Jour. Bone and Joint Surg., XIV:3:723, July, 1932.

In cases where the muscles involved are of insufficient strength to enable them to move the limb, or in very young children who cannot be made to understand what they are expected to do, the writer has been able to get the cooperation of these patients by the use of the roller skate and thus obtain the full benefit derived from active motion, which is of prime importance in the treatment of this malady.

The advantages of this method are: The ability to utilize a select group of muscles in a very weak state; ready and active cooperation by patients and parents; continuous and uninterrupted home treatment under supervision of nurse or parents.

Arthritis Deformans. By Horace Pern, M.R.C.S., L. R. C. P. (London), Leongatha, Victoria, in Med. Jour. of Australia, II:6:169, August 6, 1932.

When manipulative work is being done, the progress or not of recovery can be gauged by simple observation. Touch corroborates observation. The absence or presence of pain on pressure, and its intensity, are the surest guides in treatment; the progress to resolution can be estimated by subsidence of the pain. Touch is the sole guide in all manipulative work—the sense of resistance. The sense must be highly cultivated, so that the exact force required can be used, varying from the delicacy of touch in bending a child's stiff fingers to the utilization of all your strength in doing counter movements to a man's back. The hands of the potter are required to mould the joint back again into shape, reversing the order of things in exactly the same way as they occurred, slowly and laboriously stretching the tissues, increasing the blood supply with massage, if you have time to give it and know exactly how to apply it, by exercises strengthening the supports so that they can perform their normal function, and getting the joint used to its altered position by exercises and then counter movements, always building, never destroying structures or setting up inflammation by trauma.

When moving a joint or ordering exercises, the medical practitioner should see that full physiological use is obtained. By that I mean the full range of movement of the joint and the use of each group of muscles. All movements should be done slowly and deliberately, no jerking or rough movements being allowed.

In the acute stages put the joint at rest by wool pressure. Every time you take it down, which should be every two or three days, very gently put the joint through the range of movement allowed without producing pain; do not allow the patient to move the joint by himself. When you are satisfied the joint has recovered sufficiently, then, and not till then, make the patient, with your assistance and support, move the joint once through

the range of movement allowed without producing pain. Gradually get full mobility and allow the patient full use of the limb when all tenderness on pressure has disappeared.

If these directions are followed exactly, I am convinced not only is there no danger in moving an acute rheumatic joint, but that it is necessary to prevent stiffness and excessive repair; also it assists nutrition. It is most important always to get complete relaxation of all muscles before attempting movement.

The treatment of inflammation in all stages is the same, the combination of rest and mobility; it is simply a matter of degree—the acuter the inflammation the more rest, the less the inflammation the more the movement. The prevention of further inflammation, and assistance to resolution of the present inflammation, are obtained by support and pressure. In the acuter stages I use wool pressure entirely, and in the later stages strapping. Wool pressure is ideal; it meets all the pathological requirements. If properly applied it relieves pain, rapidly gets rid of fresh exudation, steadily but surely clears up chronic exudation, and is very comfortable. The mode of application is as follows:

Take a one pound packet of wool and use the full width; wind around the joint at least three complete turns of the ordinary thickness of the wool; if thin then wind four turns of the wool. You must have bulk of wool. Bandage over the wool firmly; apply the bandage so that it pulls the joint into the physiological position of rest. Test the top and bottom of the wool for correct pressure and to see there is no constriction; on no account bandage over skin. Use calico bandages, four inch, for all joints except elbows and hands; use two and a half inch for these and two inch gauze for fingers. Tie the lower extremity on a pillow and the upper extremity place in a sling. Take down the dressing when needed, usually from two to four days; reapply, changing the wool when it has lost its elasticity. Strapping is very useful; its two uses are to give support and to exert local pressure.

As I have already said, with experience it is possible to use rest and mobility with mathematical precision. The extreme difficulty is for patients to grasp the way to use both. Under personal treatment the joint may become free of inflammation and have complete mobility; still the cells have not completely recovered, and even the treatment which you ordered may again set up inflammation, which, if treated for a few days, would subside and the process to complete resolution go on. If rest were not substituted for mobility, then the inflammation would progress and a vicious circle be set up, the joint returning to its original condition. This is the cause of much disappointment.

The Role of Manipulation in Therapeutics. James Mennell, M.D., Cantab., medical officer, Physiotherapeutic Department St. Thomas Hospital; in British Med. Jour., No. 3737, page 341, Aug. 20, 1932.

ILLUSTRATION OF TECHNIC

To establish the point, the manipulative technic of one joint may be considered in detail—for example, that of a metacarpo-phalangeal joint of the hand.

The most valuable manipulative movement is tension whereby the joint surfaces are pulled apart. The manipulator grips the finger with what is known as the "golf club grip" with one hand, and exerts tension with the other. (The manipulative technic for all joints of the extremities is for one hand to stabilize while the other manipulates.) Then with the metacarpal fixed with one hand, the base of the phalanges is moved in an entero-posterior direction on the head of the metacarpal. (A slight degree of flexion is essential.) These two movements being free from leverage, may be performed with all the strength of which the manipulator is capable. It must then be ascertained that the lateral ligaments are free to allow the movement of the phalanx and so each is stretched to the full extent. This lateral movement is not one of adduction and abduction, any more than the antero-posterior movement is one of flexion and extension. The aim is to press one side of the phalanx down on the head of the metacarpal, while the other is pulled away from it. Rotation of the phalanx on the metacarpal must be freed, and this is achieved by flexing the distal joints so as to form a hook. The "hook" is then grasped and rotated, first in one direction and then in the other. The two movements of freeing the lateral ligaments and of securing rotation are performed with leverage, and therefore any undue exertion of force will do incalculable harm. This is the reverse of what held good for the two previous treatments.

Finally, the movements under voluntary control are reached—namely, flexion and extension, adduction and abduction. It must be remembered that the metacarpo-phalangeal joint is a sliding joint rather than a hinge joint. The base of the phalanx slides around the head of the metacarpal, with the metacarpal origin of the lateral ligament acting as center and the ligament to the phalangeal insertion acting as radius, to describe a circle. In order to perform flexion without causing damage to the entire structure the manipulator must fix the metacarpal head with one thumb and press the base of the phalanx directly forward with the other. If the phalanx is free to move at all it will glide around the head of the metacarpal and flexion will take place. If for some reason the phalanx is not free to slide around, and movement is performed as if the joint were a hinge joint, then the lateral ligament and the posterior part of the capsule are severely strained if not even actually ruptured, and the tendons of the interossei may be torn.

THE SCOPE OF MANIPULATION

The next point that arises is: "Should the art of manipulation be taught in our medical schools?" The question depends on the answer to another question: "Can benefit be conveyed to our patients by manipulation?" If so, surely it ought to be taught.

It is well for the purpose of discussion, to divide the joints of the body in two sections: those of the extremities and those connected with the spinal column. At the same time it must be remembered that, wherever situated, a joint remains a joint and as such is subject to similarity of all pathological conditions. This fact is often overlooked. Synovitis of a knee joint as a result of injury is a common diagnosis, yet few clinicians seem to consider the possibility of similar diagnosis in an intervertebral joint in the event of injury to the back.

It is usually admitted that manipulation of the joints of the extremities affords a chance of restoring movement if the full range is demonstrably lost. The manipulation may be successful if:

Active pathological processes have ceased and are quiescent;

The limitation of movement is due to adhesions;

The limitation of movement is due to a locking of two joint surfaces one upon the other;

The manipulation is performed with a skill that will lay no undue strain on any normal structure, whether an intrinsic part of the joint or not.

The first of these essentials rests with diagnosis, a far from simple matter, and one which always calls for a minute examination of the joint, and often for a wide

experience. The second and fourth essentials can be accepted without difficulty. The third raises points which might possibly cause the discussion to be acrimonious. There is a theory held by many that a joint is dislocated if displaced, and that if it is not displaced, any loss of motility must be due to adhesions only. Experiences in every day life should teach that this view is untenable. Most people have felt a sudden stab of pain in a joint if their strength is exerted to the uttermost when attempting to perform a movement just beyond their power or their reach. They check the movement at once, and, if possible, shake the part involved rather vigorously. If the back is the site of the pain, they will probably wriggle the trunk. Relief is often instantaneous. At some joints, however, this relief cannot be attained voluntarily, as the joint may not be accessible. It is then that manipulation becomes necessary. For instance, a finger can be pulled and the wrist shaken or squeezed by the patient himself, but other joints—for example, those at the base of the second metatarsal—may call for skilled manipulation before relief can be secured.

The only possible explanation seems to be that the joint surfaces have "seized up"—to use an engineering expression—and are freed by the subsequent manipulation. Experience teaches that some joints are more readily subject to this than others—for example, the joint between the proximal and distal row of carpal bones. (This is one common form of tennis wrist, which can be remedied instantaneously by manipulation.) The shoulder joint invariably escapes, but the head of the humerus may instead drop downwards unduly in the glenoid, or it may tend to retain a position too far forward in the glenoid. Should this happen disability will ensue. If the head has dropped downwards there will be pain when any movement is attempted and sometimes even without movement, and this trouble is one of the common causes of a so-called "brachial neuritis." Abduction and forward flexion become restricted if the head of the humerus does not slip backwards and downwards correctly on the surface of the glenoid, as the upper end of the humerus then impinges on the under side of the acromion and nips the synovial surfaces there. This explains why the most important point in manipulation of the shoulder is to press the head of the humerus backwards in the glenoid. It also shows how manipulation can have disastrous sequels if this precaution is disregarded.

THE WONDERFUL CURE

Manipulation as a possible means of relieving symptoms other than pain is ground full of pitfalls and danger. The worst danger is erroneous diagnosis. Pain in the right iliac fossa, for example, may be due to sensitiveness of the ligaments on the anterior aspect of the sacroiliac joint. Should the tension on these ligaments be relieved by manipulation, the pain will disappear, and the patient will broadcast the wonderful "cure" of what had been diagnosed elsewhere as "chronic appendicitis." In this case the pain has been cured, but not "appendicitis," as this did not in fact exist.

Occipital neuralgia may be referred from a lesion of the cervical spine. When severe it may be associated with a feeling of nausea akin to migraine. This pseudo-migraine can be cured or alleviated, and the frequency of the attacks reduced by manipulation. The degree of benefit derived is directly proportionate to the degree of pseudo-migraine super-added to a true migraine.

A spasmodic torticollis is sometimes due to irritation within one or more of the joints of the cervical spine, and may be amenable to manipulative treatment, particularly if the complaint started as a direct sequel to accident. I have seen one case in which spasm of the diaphragm was associated with a sudden loss of mobility of the third cervical vertebra. The occurrences were simultaneous during sleep, and the spasm was relieved as soon as mobility was restored by means of suspension.

Colle's Fracture. Harry Platt, M.D., M.S., F.R.C.S., Senior Hon. Surgeon and Surgeon in Charge, Orthopedic Service, Ancoats Hospital, Manchester; Consulting Orthopedic Surgeon, Lancashire County Council; clinical lecturer in orthopedic surgery, University of Manchester; in British Med. Jour., No. 3736, page 288, Aug. 13, 1932.

MOBILIZATION

Complicating views are held regarding the length of time during which a Colle's fracture should be completely fixed by splints or plaster and the stage at which physiotherapeutic treatment should be introduced. It will be generally agreed that fractures without displacement can be treated with impunity by a short period of fixation and by early mobilization of the wrist and inferior radio-ulnar joints. On the other hand, it has been established beyond all doubt that (a) in the average fracture with displacement firm consolidation rarely takes place before the end of the fifth week; and that (b) in certain circumstances in a fracture well reduced joint deformity—and more particularly backward tilt—is liable to reappear during the first three weeks. Thus the frequent removal of splints during the period of fixation for the purpose of physiotherapeutic treatment is likely to be a hazardous procedure. The question therefore arises as to how far the ultimate functional results are influenced by the employment of physical treatment in the early stages. On this point I believe that my experience has enabled me to form an unprejudiced opinion.

For a number of years in my own hospital clinic it was routine to begin light massage to the limb at the end of the first week. The treatment was given under water in an arm bath with the fracture curve supported by pressure applied directly over the fragments. Active movements of the wrist joint in the direction of palmar flexion only were allowed after the tenth day, and rotation of the forearm towards the end of the third week. After each sitting the splints and controlling pads were accurately reapplied. These cases were entrusted only to senior students of the massage school acting under continuous supervision. On the whole, I found little cause for dissatisfaction with the standard of functional results obtained under this regime. But it became obvious that this method of handling such a common injury as Colle's fracture, though providing valuable training for the students in the massage school, consumed far too much time and energy and was frankly uneconomical. Further, in spite of the most careful supervision, from time to time I was confronted with cases of recurrent deformity after reduction—and contretemps usually discovered in the third week. For the past three years I have entirely eliminated active physiotherapeutic measures during a period of fixation which lasts five weeks; and, afterwards, only those patients who are likely to be slow in obtaining full mobilization by their own unaided efforts are treated in the massage department. But during the fixation stage the injured limb is by no means regarded as an idle appendage. After the first day the patient begins a definite scheme of activity which embraces all the joints of the upper extremity except those temporarily immobilized—that is, the wrist and radio-ulnar joints. This plan which is based on the practice of Bohler, is most easily followed out when the fracture is securely controlled in an accurately fitting plaster splint which cannot be displaced. For the greater part of this time no sling is required, and the freedom of the

fingers, elbow and shoulder allows the patient to use the limb for many domestic or professional duties.

It has thus been possible for me to make a comparison between the two popular methods of treating Colle's fracture. I am compelled to conclude that nothing has been lost by the elimination of early physiotherapeutic treatment; that the risks of recurrent deformity have been minimized; and that in the average fracture treated by plaster fixation for a period of five weeks the nutritional condition of the limb at the end of that time is, if anything, better than in a similar fracture treated by physiotherapeutic measures from the second week onwards.

A Note on the Movement of the Shoulder Joint. C. P. Martin, University anatomist, Trinity College, Dublin, in British J. Surg., xx:77:61, July, 1932.

SUMMARY

Abduction of the arm is a complicated movement consisting of true abduction of the humerus at the humeroscapular joint combined with rotation of the scapula and elevation of the clavicle. But, in addition to these factors abduction of the arm is always accompanied by lateral rotation of the humerus to an extent of over 90 degrees. This rotation takes place for the most part during the later stages of abduction when the arm is raised from the horizontal position until it is vertically upright, but a certain amount of it occurs during the first half of abduction. It is on account of this lateral rotation of the humerus during adbuction that the position of the humerus at the end of full abduction is exactly the same as it is at the end of full flexion. This lateral rotation of the humerus during abduction of the arm has not, as far as I can find, been described in any publication previous to this paper.

A Consideration of Backache from the Orthopedic Standpoint. W. A. Cochrane, F.R.C.S., Ed., Assistant Surgeon Royal Infirmary, Edinburgh, in British M. J., No. 3733, page 138, July 23, 1932.

TREATMENT

A useful clinical application of low back pain is as follows: (1) acute traumatic strain; (2) general postural strain; (3) lumbo-sacral strain; (4) sacroiliac strain; (5) combined pelvic joint strain.

In conditions of acute traumatic strain there is usually a tear of muscle or aponeurosis. Treatment of a torn muscle must consist of rest until healing has taken place. Most of these patients with industrial back accidents are allowed to use the muscles too soon and with insufficient protection. If there is a super-added infective focus in the body, this may be a factor in keeping up the painful muscle spasm which tends to persist. Such fixation is crippling, and manipulation under anesthesia offers the best chance of cure. To secure the required rest the patient should be made recumbent on a firm mattress and have the back splinted with straps of broad adhesive strapping placed transversely across it. The knees are supported on a pillow. In severe cases a plaster of paris jacket should be employed or recumbency in a plaster shell. Heat in the form of hot fomentations, massage and exercises are begun immediately, and the average case should be allowed up in about three weeks.

In general postural strain the condition is one of general muscular fatigue, and ligamentous strain not confined to one joint. The patient is usually of the aesthetic type. Such cases require nutritional and supportive treatment by rest, massage, postural remedial exercises and supported by a brace and corset.

In lumbo-sacral strain the pain is localized in an indefinite way over the low spine and hip. The pain is usually asymmetrical, and sciatica is a frequent symptom. This kind of backache is generally relieved by rest. The lumbar and lumbo-sacral movements are markedly limited, and there is localized tenderness on deep pressure over the lumbo-sacral articulations. This point may be best made out by examining the patient kneeling on his hands and knees. Treatment is very largely similar to that mentioned for acute traumatic strain. One important exercise is to teach the patient to flatten the lumbar spine, and a brace is employed to span the lumbar curve and to help the muscles to maintain its position.

In contrast to lumbo-sacral strain, which usually affects one side and is relieved by recumbency, sacro-iliac strain is commonest in the slender, visceroptotic types who use the body in poor posture. Tenderness is referred to the joint on its posterior and inferior aspects. There is hamstring spasm when the patient bends forward. Treatment of the condition is as under the previous section.

When these methods are unsuccessful, and in the more acute cases, the patient must have the joint manipulated under an anesthetic. The assistant fixes the pelvis and opposite limb. The surgeon then flexes the affected hip with the knee straight to the right angled position, and pushes directly downward.

Lumbo-sacral and sacro-iliac strain may occur together owing to the faulty mechanics to which a large lumbo-sacral transverse articulation can give rise. In very severe cases of semi-sacralization a fusion operation to fix the lumbo-sacral region by means of a bone graft may be indicated. Prolonged, fixation, however, for several months in a complete plaster spica casing has succeeded in curing a large proportion of the cases.

Reducing Diet in Orthopedic Surgery. Emil S. Geist, M.D., Minneapolis, Minn., in Jour., Bone & Joint Surg., XIV:3:693, July, 1932.

Spine.—We believe that excessive weight in itself may be the cause of many bachaches. We always attempt to bring the weight to normal (for the height and age) in the following conditions: lumbosacral strain, spondylolisthesis, round shoulders and postural defects. In adult scoliosis which is causing the pain, this method has spared several of our patients a fusion operation.

Hip.—A painful senile arthritic hip in a heavy man often becomes comfortable from weight reduction alone. Some of our most grateful patients belong to this class.

Knee.—Chronic unilateral or bilateral arthritis from whatever cause in the later adult years offers a fruitful field. Occasionally reduction alone totally removes all subjective symptoms. While we, of course, as a rule avail ourselves of other therapeutic measures (chiefly physiotherapy and splinting), we have a small series of cases in which the desired relief of any symptoms was obtained by the sole use of a restricted diet.

Fractures.—The obese are poor fracture risks when viewed from any angle. It is a good fracture prophylaxis for all of us to remain thin and supple.

In heavy, fat, adult individuals we begin a reducing diet from the onset of the treatment. We believe it to be good therapy not to demand too much of a recently healed weight bearing bone.

The old malunited fracture of the hip, knee, ankle, or foot often becomes comfortable on removal of the overload. In our practice numerous patients have thus avoided operative interventions.

CONCLUSIONS

Consideration of a proper reducing diet has become, in our work, of daily necessity and occurrence and of practical value.

A chronically painful joint or series of joints of the spine or lower extremity often ceases to be troublesome in an individual who has been overweight and who, by means of a reducing diet, has brought his weight to normal.

The amount of overweight need not be large,—occasionally the removal of ten or fifteen pounds is enough to spell the difference between comfort or pain in a given case.

This method in proper cases is an adjunct to other forms of treatment used in orthopedic surgery.

The Treatment of Osteomyelitis in the Warm Salt Water Pool. A. Brockway, M.D., Los Angeles, Calif., in Journal Bone & Joint Surg., XIV:3:611, July, 1932.

During the past few years there have been a number of new ideas advocated for the treatment of this very stubborn disease, and the writer would hesitate to present a still different outline of treatment, but for the fact that he is convinced that the method to be described here embodies certain definite principles in the treatment of infection and joint healing that makes it well worth bringing before the medical profession. While we have used the warm salt water pool in all types of non-tuberculous osteomyelitis, it has its greatest field of usefulness in those cases where the involvement is in close proximity to the joint line or where the process involves the joint structure as well.

SUMMARY

Eleven cases of osteomyelitis have been treated in the warm salt water pool. Theoretically, the principles of treatment seem sound and by actual practice the method has given worthwhile results. It is particularly suited to those cases where the osteomyelitis process involves the joint or is in close proximity to the joint.

This method of treatment embodies and makes use of definite well recognized principles in the treatment of infection and joint regeneration,—namely, adequate drainage and immobilization. After the acute stage absolute rest is not maintained, but after the first month the plaster cast is removed and the patient immobilized in bed by light traction, by splints or by bivalved casts. Daily pool treatment is then started, but even this is comparative rest since motions in the pool are performed with a minimum of effort. No effort is exerted by the patient in getting in and out of the pool, since this work is done by an overhead electric traveling hoist with the patient lying on a stretcher.

Past experience in the treatment of suppurative arthritis has proven the proposition that physiological stimulation of a joint is the best means of ensuring maximum return of motion in the diseased joint and a regeneration of joint structure. This principle is made use of in the salt water pool treatment without jeopardizing the cardinal principle of rest.

The salt solution being strongly hypertonic, drainage of the infected tissue is accelerated because the difference of osmotic pressure existing between the solution and the body fluids causes an out-flow of the latter from the diseased area.

Active movement in the water avoids the production of inhibitory spasm from pain or fear of pain as is usually produced by other forms of physiotherapy and muscle re-education movements.

The treatment is soothing and is enjoyed by the patient, as compared with spending months of inactivity in ill smelling casts.

Vasodilatation in the Lower Extremities in Response to Immersing the Forearms in Warm Water. John H. Hibben, Jr., and Eugene M. Landis; Jour. Clin. Investigation xi:5:1019, September, 1932.

(From the Robinette Foundation of the Hospital of the University of Pennsylvania.)

Several tests have been proposed, and are now in general use, for estimating the grade of organic occlusion existing in the blood vessels of an extremity. The principle underlying these various methods is similar. The surface temperature of the distal portion of the cool exposed extremity is measured thermoelectrically. Dilatation of the peripheral vessels is then produced and the coincident rise in surface temperature is recorded. The level to which the temperature rises with complete vasodilatation has been determined in individuals with normal peripheral circulation. If the surface temperature fails to rise to this normal level the arteries supplying the part are regarded as being unable to dilate due to organic changes in their walls.

One of the earliest methods of producing vasodilatation in the extremities in man was suggested by Brown and consists in producing fever by the intravenous injection of typhoid vaccine. Morton and Scott induced vasodilatation in the lower limbs by means of spinal anesthesia, and later proposed the use of general anesthesia, either nitrous oxide or ethylene for the same purpose. Injection of peripheral nerves with novocaine has also been used to produce local vasodilatation by White, Lewis, and Scott and Morton. Still more recently Lewis and Pickering studied the vasodilatation in the hands produced by warming the body. The subject was seated in a small hot air chamber with the head and hands projecting into a cool room. Heating the air in the chamber to a temperature of 46 degrees C or more was followed by a rise in the skin temperature of the hands. They suggest that the method may also be used to produce vasodilatation in the feet.

The following report describes the effects which warming one or two extremities exerts on the skin temperature of the other extremities, with special emphasis on the vasodilatation in the feet produced by immersing the forearms in warm water. The mechanism by which this vasodilatation is induced has been studied in normal subjects. The simplicity of the method and apparatus, as well as the constituency of the reaction in normal subjects, suggests that the procedure might have a certain value in the diagnosis of peripheral vascular diseases. Only three illustrative cases are described; a more comprehensive clinical study will appear later.

METHOD

The observations on normal subjects have been carried out at room temperatures varying from 11.4 to 21.5 degrees C. The subjects were seated in a chair with the feet raised on a stool about a foot from the floor. Room temperature was read from a mercury thermometer suspended in the air near the extremities. The surface temperature of the toes was determined thermoelectrically in the usual manner. The thermal junctions were placed in contact with the skin on the dorsal surface of the distal phalanx just proximal to the base of the nail. In some instances the junctions were bare and in others a single layer of surgeon's plaster covered the junction without modifying the results significantly. Skin temperatures were measured at two-minute intervals while the exposed extremities cooled, and when the skin temperature was sufficiently low (usually 25 degrees C. or less) the forearms were immersed in warm water (43 to 45 degrees C) to a point just above the elbows. For this purpose ordinary white enameled arm baths, 52 cm. long, 20 cm. wide and 15 cm. deep, were entirely satisfactory. The temperature of the water was kept between 43 and 45 degrees C by means of a small electrical heating coil

placed beneath each bath. While the forearms were immersed in warm water skin temperature and room temperature were read every minute.

While the primary object of these experiments was to study vasodilatation in the lower extremities, a certain number of observations were made upon the vasodilitation in the hands produced by immersing the legs in warm water. In these experiments the method was essentially the same. The hands were exposed until cool, then the legs were immersed in warm water to a level midway between the ankle and the knee. The two receptacles used as foot baths were metal cans, open at the top, 24 cm. square and 35 cm. deep. At the bottom of each can a small wooden frame weighted with lead prevented the sole of the foot from coming in contact with the metal. The bath was maintained at a temperature of 43 to 45 degrees C by means of a small heating coil beneath each can.

SUMMARY

In normal subjects immersing the forearms in warm water (43 to 45 degrees C) produced vasodilatation in the lower extremities. In ten observations on the spontaneously cooled extremities of six normal subjects the rise in digital skin temperature began within fifteen minutes after immersing the forearms in water. The skin temperature in all but one of these observations exceeded 32 degrees C by the 29th minute.

The immersion of one forearm or one leg in warm water produces vasodilatation in the other extremities.

This type of vasodilatation apparently depends upon the return of warmed blood from the immersed extremity.

The rise in rectal temperature produced by immersing two limbs in warm water ranged in three experiments from 0.1 degree C to 0.6 degree C.

Three cases illustrating vasodilatory responses in certain types of vascular disorders of the extremities are reported. With this method of producing vasodilatation if the digital temperature rises above 32 degrees C organic occlusion of the vessels supplying the extremity may be excluded.

The Clinical Results of Carbon Arc Irradiation Upon Children. George W. Caldwell, M.D., New York, in Arch. Pediat., xlix:8:487, August 1932.

The following is a report of the clinical results obtained in a series of twenty-nine children who received regularly daily exposure to radiation from carbon arc lamps.

The exposures were given daily and continued from eleven to forty-two days. The twenty-three children who received daily irradiation from the carbon arc described above began with an initial exposure of five minutes anteriorly and posteriorly at a distance of twenty-four inches measured from the anterior surface of the door of the lamp. The length of these irradiations was increased by ten minutes each day and the distance between the patient and the lamp decreased by three inches every three days until a maximum of from twenty to one hundred minutes irradiation at a distance of fifteen inches was given daily.

Of this group there were ten which showed a mild erythema which appeared more than four hours following the exposure and which entirely disappeared at the end of twenty-four hours. There were also ten patients who showed a mild pigmentation. This mild cutaneous reaction would seem to be advantageous, since Eidinow reports that the application of an erythema-producing dose renders the radiated area immune to further reactions for a period of three to four days. This is due to the protective filtering action of the exudates in the interepidermal tissues. If radiation has been sufficiently intense to cause death to the epidermal cells, the area is immune to the rays until desquamation has occured. In the presence of desquamation the exposed tissue is hypersensitive to light. This produces an irregular action since the hypersensitive areas are separated by immune areas. If the skin is to be kept light sensitive, erythema-producing doses should be avoided or sufficient time elapse between the radiations so the skin may return to a light receptive state. In thirteen of these cases a fine wire mesh screen was used in the door of the lamp, and in ten cases ultraviolet transmitting glass was used. This glass is two millimeters in thickness and designed particularly to transmit ultraviolet rays of greater than 2,800 a. u. wave lengths. These waves are as short as have been found by spectral transmission tests to radiate from this carbon. There was no noticeable difference in the cutaneous reaction with the use of the screen and with the glass.

Of the six cases which received radiation from the ultraviolet carbon, three were irradiated with the waves passing through ultraviolet glass and three were irradiated with the waves passing through the screen. Because the spectral transmission of this carbon reached 2,200 a. u. wave length, shorter exposures were given. These patients received the first exposure at a distance of twenty-four inches for five minutes ventrally and dorsally. This was increased by five minutes each day and the distance decreased by three inches every three days until the patients received a maximum of twenty to ninety minutes at a distance of fifteen inches. The longer exposures, except for case 29, were given with the glass in the door of the lamp and this cut out the rays shorter than 2,800 a. u. These children in three instances received a mild erythema appearing after four hours, and in one case there was intense erythema following a prolonged exposure when the wire screen was used in the door of the lamp in place of the glass. Pigmentation was present in five of these cases.

Of the total number of twenty-nine cases that received irradiation there was an increase in the factor of CaxP in twenty-two or 73 1/3 per cent at the end of the irradiation period. Of the remaining, eight or 26 2/3 per cent, there was a decrease in the factor of CaxP. This may be explained by the presence of some pathological state.

CONCLUSION

Beneficial effects were demonstrated in 73 1/3 per cent of these children receiving daily irradiations from carbon arc lamps. The use of the sub-erythemal dose proved effective. No untoward symptoms appeared after long exposure to radiation from the carbon having a spectral transmission simulating sunlight.

The carbon just referred to is safe to use with the average individual. With this carbon there were only very mild cutaneous reactions both in respect to erythema and pigmentation. This, however, apparently had no effect upon the benefit which these children received by way of stimulation of their mineral metabolism as evidenced by the blood calcium and phosphorus findings.

From this series and from the reports of others, it seems to bear out the evidence that ultraviolet rays are more effective where they are allowed to act upon a normal healthy skin which is not pigmented and which is not reddened by erythema, since it is generally accepted that pigmentation and erythema do inhibit to a certain extent the action of the shorter ultraviolet wave lengths.

The Relation of Ultraviolet to Nutrition. Harriette Chick, D.Sc., London; in Lancet II:7:326, August 13, 1932.

TRANSPARENCY OF HUMAN SKIN TO ULTRAVIOLET RADIATION

The possibility that ultraviolet rays may penetrate the skin epidermis and act directly on the ergosterol in the blood present in the capillaries beneath has also been explored. The penetrating power of these rays is, however, generally believed to be extremely small, and any direct action would therefore be limited to a very thin layer of skin. No satisfactory method has yet been devised to surmount the obvious difficulties of making such measurements in vivo, and most of the available data are derived from experiments with detached skin or epidermis. Lucas, whose technic was designed to lessen some of the errors in measurements caused by the changes due to removal of the skin from the living animal, has found the transparency of the human epidermis to be greater than other observers (Angus and Taylor, Proc. Roy. Soc., B, 1931, cix, 309; and K. A. Hasselbach, Skan. Arch. f. Physiol., 1911, xxv, 55.) for radiations of wave lengths which include the antirachitic zone of the sun's radiation. For a layer of epidermis of thickness 0.08 mm., transmission was 55 per cent of incident radiation of wave length 313 millimicrons, 44 per cent for 300 millimicrons, falling sharply to three per cent at 289 millimicrons. If it be assumed that the antirachitic rays can penetrate the epidermis and reach the capillaries, there might be a direct action on the blood. Clark has shown that irradiation with ultraviolet rays causes an increase in the diffusible calcium in serum, and this action may be involved in the calcifying action of sunlight.

The Relation of Ultraviolet Light to Nutrition. Harriette Chick, D.Sc., Lond., of the Division of Nutrition, The Lister Institute, London; in The Lancet II:8:377, August 20, 1932.

OTHER EFFECTS OF IRRADIATION ON THE ORGANISM

Evidence is most contradictory regarding the existence of any specific effects of irradiation, which might be related to nutrition, other than that on the mineral metabolism. D. T. Harris described experiments showing effects of ultraviolet radiation in stimulating gaseous metabolism of rats and to this action he found visible light rays to be antagonistic, but his observations lacked confirmation.

The observed good effects of open air treatment on certain forms of tuberculosis and other diseases have been attributed to the specific action of ultra-violet light on metabolism, but many of the observations lack scientific precision or objective criteria for comparison, and the basis of this form of therapy must be regarded as mostly empirical at the present time. Among the researches, however, in which efforts have been made to analyze the various factors involved, are the large series of clinical investigations emanating from the school of Kestner at Hamburg. Kestner and his colleagues had adduced evidence to show that the raised oxygen consumption of healthy persons at high altitudes and the increased nitrogen retention and accelerated regeneration of red blood cells and rise in hemoglobin content of the blood, observed in ailing children in seaside or mountain sanatoria, are attributable, in part at least, to the increased exposure to sunlight. Beneficial effects of ultraviolet irradiation on regeneration of hemoglobin have also been reported with various forms of secondary enemia produced experimentally.

A series of well-controlled observations on young infants by Mackey, however, gave results directly opposed to these views. Among over two hundred infants under two years of age, observed as our patients in the London hospital, no favorable effect on the hemoglobin content of the blood was detected in those receiving regular ultraviolet irradiation from a mercury vapor quartz lamp during the winter months, as compared with the control children receiving no such treatment. Both groups were ordered cod liver oil to ensure a sufficient supply of vitamin D. No advantage was observed in the irradiated children as regards any improved gain in weight, in mental or physical progress, or in increased resistance to infection. Similar results were obtained by Colebrook.

A series of experimental and clinical researches by Clark and her colleagues in Baltimore have failed to discover any influence of ultraviolet irradiation in raising the resistance of the irradiated organism to infective agents. These researches included observations on experimental infection of rats with pneumococcus, and of chickens with fowl cholera, and on the effect of local irradiation of abscesses in rabbits caused by Bacillus lepisepticus. In an observation on 363 student volunteers at the Johns Hopkins University no enhanced resistance to the common cold or to more serious respiratory infections could be detected among the group receiving systematic irradiation with the ultraviolet rays from a mercury quartz lamp throughout the winter, as compared with a control group receiving no irradiation.

As a matter of fact, some of the well-established effects of ultraviolet irradiation must rather be regarded as those pathological in cure, as for example, the effect in causing skin erythema and pigmentation. There is evidence that the last may be a protection mechanism against further damage. The observation that "good pigmenters do better" when undergoing sun treatment may be due to the fact that such patients are able to enjoy the general stimulating effects of the regime without the drawbacks—the discomfort, the restlessness and sleeplessness—which may follow over-dosage with ultraviolet rays.

The proved effects of ultraviolet irradiation on the calcium metabolism may, however, be so far reaching as to affect every department of the living economy. Although the bones and teeth contain most of these elements, every tissue in the body needs sufficient of both calcium and phosphorus for its correct function, and if, from any cause, the correct utilization of these minerals is disorganized, it is clear that the whole organism will suffer. This is especially true in those times of life when the need for these minerals is greatest, as, for example, when extra supplies are required to support the growth of the bony tissues in children or to bear the strain of pregnancy or lactation in women.

Prevention of Cancer of the Skin and Buccal Cavity. By E. H. Molesworth, M.D. (Sydney), Lecturer in Dermatology, The University of Sydney; Honorary Dermatologist, Royal Prince Alfred Hospital, Sydney, in Med. Jour. of Australia, II:7:196, August 13, 1932.

On the contrary, while the beneficial effect of sunlight and ultra-violet rays is admitted by all, it also holds good that such agencies can be abused. As I mentioned in a previous publication, there is no good thing in which over-indulgence is not harmful. Food and drink, work and play, can all be overdone and thereby result in disease and death. So also can disease and death result from over-exposure to sunlight and ultra-violet rays. The hatless brigade undoubtedly courts the results of this over-exposure. Fortunately this cult does not extend beyond the cities to any real extent, at least at present, but the dangers of it should be impressed upon the community.

It is often put forward that, as cancer of the skin does not occur in youth, exposure without a hat does not matter for boys. This, I am convinced, is bad teaching, since it is more than probable that cancer of the skin is the result of the sum total of chronic sunburnings from childhood up, and not of single or widely separated severe exposures. I question the wisdom of prescribing a shadeless cap as compulsory wear for boys attending particular schools, especially in summer, and if their subsequent vocation is going to be an outdoor one. One often sees on the beaches boys and even girls with a skin sprinkled with freckles engaged in the hopeless attempt to accustom themselves to sunburn and develop the fashionable bronzed appearance of other frequenters of the beach. One feels tempted to paraphrase the biblical axiom and say: "The red-haired youth cannot change his freckles for the black of the Ethiopian's skin." I have seen multiple rodents in a youth of twenty with red hair and freckled skin.

The Education Department of New South Wales recently issued to teachers some instruction on this point, and it would be valuable to extend this practice so as to reach the pupils of all schools, State, public and private, in order that all might learn in their youth the dangers of overdoing exposure to the sun, as well as the benefits of outdoor habits.

It should be taught that the practice of going about in sunny weather without a hat is harmful, especially to fair-skinned people, even in youth, and that school caps providing no shade are unsuitable for summer wear.

In adult life, and even in occupations of the farming and pastoral variety, a great deal of avoidable exposure is undergone by many people. The country man usually wears a hat affording little or no more shade to his face than that worn by the city dweller and indoor worker. A hat with a much wider brim, like that of the sombrero, should be provided by the hat manufacturer, and could be advertised by them if recommended by some such body as this as suitable for men occupied in outdoor pursuits. It might be described as absolutely essential if the wearer is fair skinned or freckled. Such persons should also be taught to ride or drive with sleeves down and hands protected by some sort of mitten or gauntlet whenever possible.

SUMMARY

1. Cancer of Skin and Lip.—It would seem desirable to publish through educational institutions that undue exposure to sunburn is damaging, even in youth; and by other channels that in order to prevent cancer of the skin, hats should always be worn outdoor occupations and pastimes, and that a hat with a much wider brim than the ordinary town variety should be worn by men in farming and pastoral pursuits.

2. In Cancer of the Mouth.—(a) Measures should be taken still further to improve the facilities and efficiency of treatment of syphilis in early stages. By this means it should be possible to insure a still larger proportion of cures in this disease, which undoubtedly seems to predispose to cancer of the mouth. (b) Measures of mouth hygiene should also be taught to the public, since rough teeth and inflammatory conditions in the mouth seem to predispose to cancer of the mouth. (c) A campaign against smoking is obviously futile, but even if possible, the benefits to be looked for are problematical.

The Bactericidal Action of Ultraviolet Irradiation of Tubercle Bacilli. Edgar Mayer and Morris Dworski in American Rev. Tuberculosis, xxvi:2:105, August, 1932.

Various investigators, including the authors, have reported on the bactericidal action of ultraviolet energy on tubercle bacilli. However, there has been a paucity of quantitive data, both as to the amount of energy necessary to cause the lethal effect and to the number of microorganisms irradiated. In this connection we have endeavored to furnish the information.

DISCUSSION

Sufficient experimental evidence has been reported and confirmed to state that ultraviolet light has a direct bactericidal effect on bacteria. By far the best work to date on the lethal effect of ultraviolet energy on bacteria is the recent investigation by Gates (F. L. Gates, Journal of General Physiology, 1929, xiii:231-249; and xiv:31, 1930). With monochromatic ultraviolet radiations and staphylococcus aureus as the test organism, he found that the bactericidal action did not increase with the shorter wave lengths. He further demonstrated that the rate of bactericidal effect yielded similar curves at each wave length but that the energy levels varied with the greatest bactericidal effectiveness between 250 and 270 millimicrons.

Six times the lethal dose of ultraviolet energy did not alter the form or modify the straining characteristics of the tubercle bacillus irradiated in suspension; yet sublethal doses of ultraviolet energy affect the bacterial protoplasm, for Toda dissociated tubercle bacilli into R-forms and S-forms by radiation with a mercury quartz arc. Furthermore, he was able to kill the R-forms with a four-minute exposure while the S-forms required ten minutes.

Tubercle bacilli fixed by heat and then exposed to the rays, showed definite alterations in shape and irregularities in staining.

It appears that a preliminary application of heat sensitizes the bacteria, so that they become more susceptible to the destructive action of the rays than do unheated organisms.

CONCLUSIONS

A suspension of tubercle bacilli containing 2,750,000 organisms per cc. was killed within four minutes by the absorption of 1.42×10^6 energy ergs per cm.^{2} derived from the complete ultraviolet band of a mercury quartz arc (Kromayer).

A like amount of energy destroyed dried tubercle bacilli on the same suspension within four minutes.

Exposure of tubercle bacilli in suspension to ultraviolet at 5.93×10^6 ergs per second per cm.^{2} for twenty-five minutes did not alter their acid fast staining properties.

Tubercle bacilli fixed by heat and then irradiated for five to twenty-five minutes showed changes indicative of disintegration and irregularities were observed in staining by the Ziehl Neelsen method.

The Climatic Treatment of Tuberculosis. Earl H. Bruns, in Amer. Rev. Tuberculosis, xxvi:2:124, August, 1932.

As the most favorable climate for the treatment of tuberculosis, we have in mind a climate with change of season, a dry climate so that the heat of summer is not depressing and the cold of winter, while stimulating, can be endured in comfort, a climate with a maximum amount of sunshine, because heliotherapy is of importance in the treatment of tuberculosis. Fine weather and bright sunny days have a good psychical effect on tuberculosis patients. Such climates must be sought in high altitudes. The amount of water in the atmosphere diminishes as the distance above the sea level increases, and this greater dryness of the air makes it easier for the body to lose heat by evaporation. The loss of superfluous body heat takes place more rapidly in dry air, and at the same time the cold of dry air is more easily borne than the cold of moist air. The therapeutic effect of high altitude may,

therefore, be attributed to drier heat, drier cold and increased sunshine.

A recent survey made by myself by means of questionnaires sent to each of 563 physicians registered in Denver elicited replies from 550. Sixty-eight of the doctors questioned were born in Colorado. One hundred and thirty, (27 per cent), based on 482 not coming from the state, are here on account of tuberculosis, 85 in themselves and 45 for some member of their family; 511 (92.9 per cent) replied that they believed in the climatic treatment of tuberculosis; 14 (2.5 per cent) stated that they did not believe in the climatic treatment of tuberculosis; twenty-five (4.5 per cent) did not answer the question. The result of this survey would certainly indicate that western physicians sponsor climatic treatment, and, when members of the medical profession develop tuberculosis themselves or are confronted with the treatment of the disease in some one of their own family, they seek the benefit of the climate. Unlike many others, as a rule, they do not linger and finally use climate as a last resort treatment. Patients of limited means frequently take their cure at or near home and, when they fail to recover, migrate in an advanced and terminal condition to some health resort. They go full of hope and expectancy, even leave excellent institutional care to live in some inexpensive boarding house without proper medical attention. The result is sad and tragic. Their lives are shortened and much suffering occurs. This phase of health seeking has caused the chambers of commerce and civic organizations in our western municipalities to cease stressing climatic advantages—in fact, to discourage the acquirement of new citizens by this means.

The demand of climate in the cure of tuberculosis is not so common as formerly and, as a result, tuberculosis practice has decreased in the west. When we pause to reflect, however, we can readily think of other reasons for this change. No doubt climatology, so far as tuberculosis is concerned, is not advocated by eastern physicians as much as in the old days. The modern treatment of tuberculosis was then just beginning. Only the incipient cases were considered worth while treating. Most sanatoria would not accept the advanced consumptives, by far in the majority, and the physician on his part had little to offer. No wonder, therefore, that many victims of the disease turned to nature and sought the help of the climate. Now we have a well-established and definitely formulated hygienic regime for our patients, which gives results, and, above all, collapse therapy has made a revolutionary advance in our treatment. The outlook for the consumptive is brighter, even for the advanced cases, and they are no longer influenced by lack of treatment and reassurance to come west. The well to do still come. They are the ones who can afford it and we might say profit most. However, this train of events has worked to one disadvantage. To a certain extent it has shaken the popular faith in climatic treatment and lessens the good psychological effect which prevailed in former times. It has been said that a tuberculosis specialist's views on the therapeutic benefits of climate depend on where he is practicing. If it is part of his stock in trade, he naturally lauds the virtues of the climate in the particular region of his practice and by his own enthusiasm arouses the same hope and firm belief in the minds of his patients. This, in some instances is the keynote which prevents the collapse of the entire structure of treatment and leads to recovery in the end.

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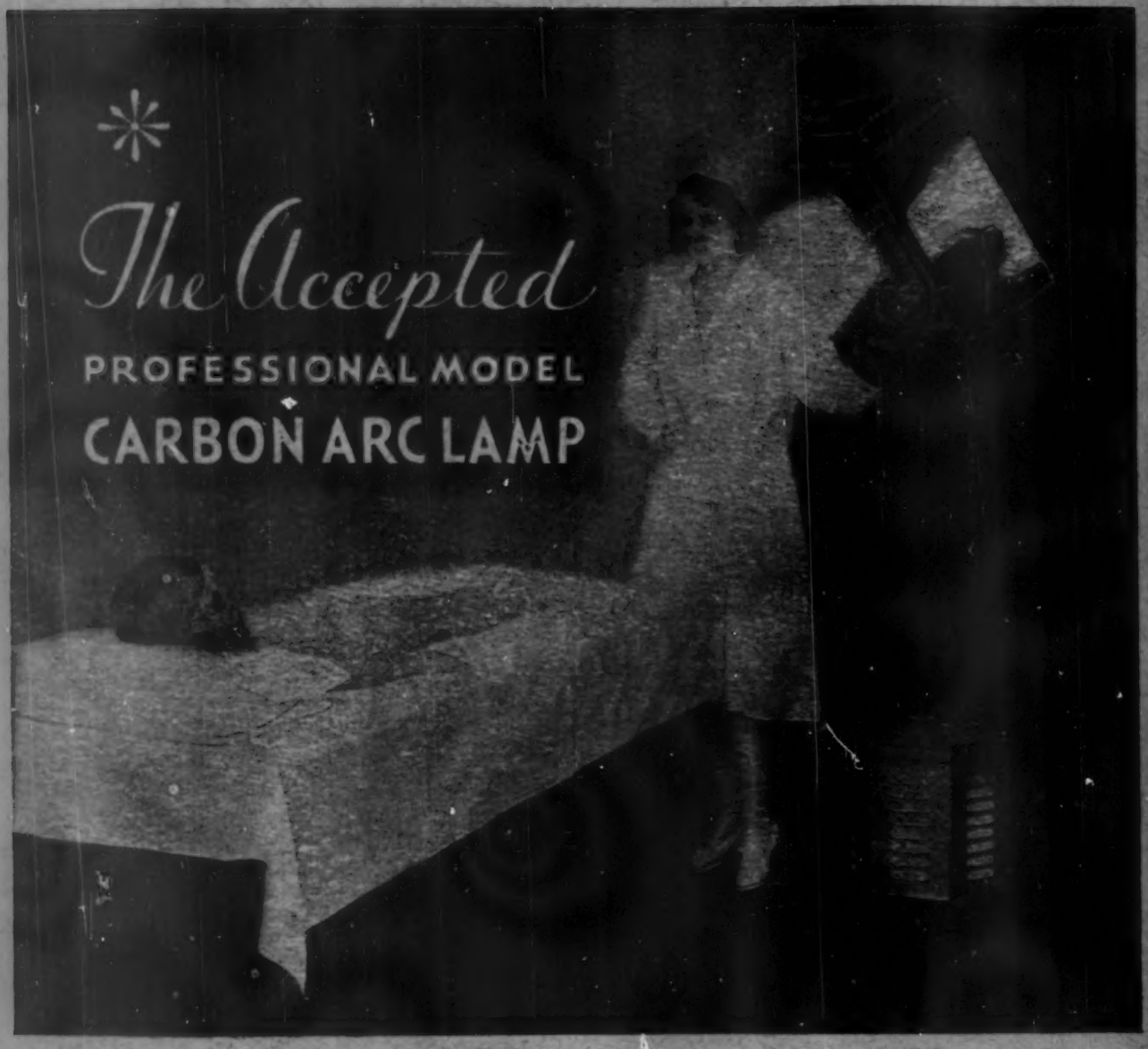

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